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AMERICAN MACHINIST

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Index to Advertisers and Classified Index Following Reading Matter.

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Universal Milling Machines

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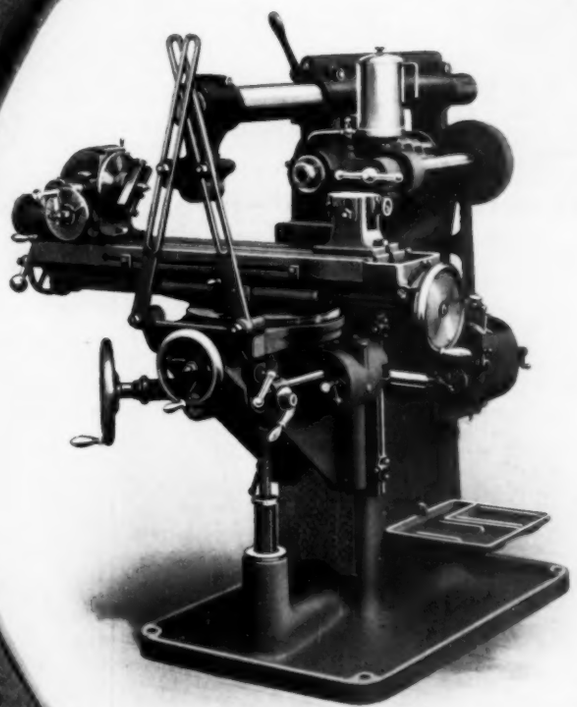

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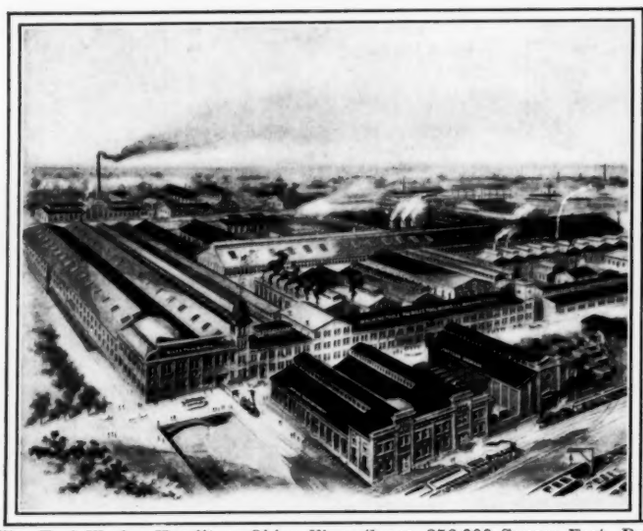

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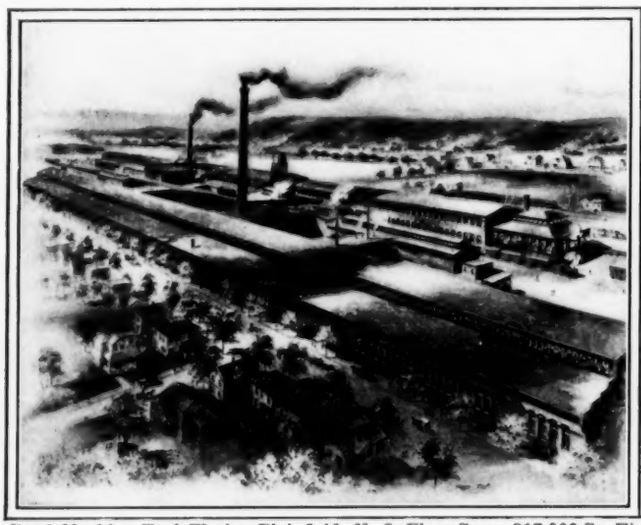

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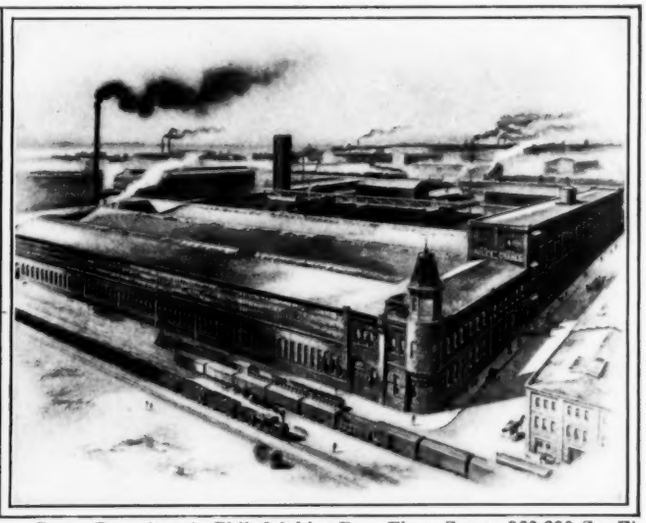

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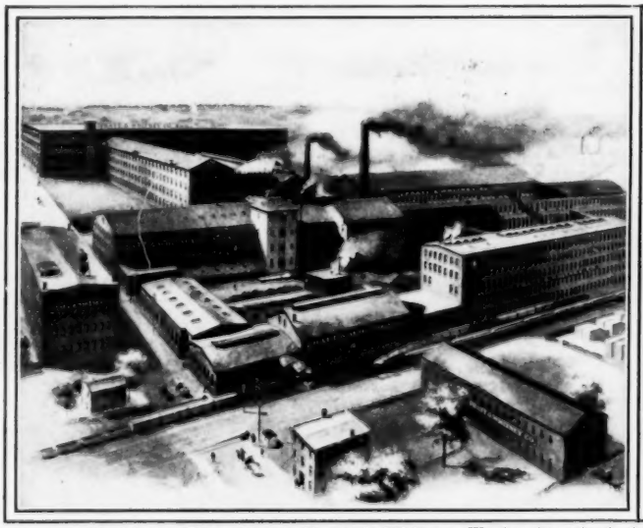

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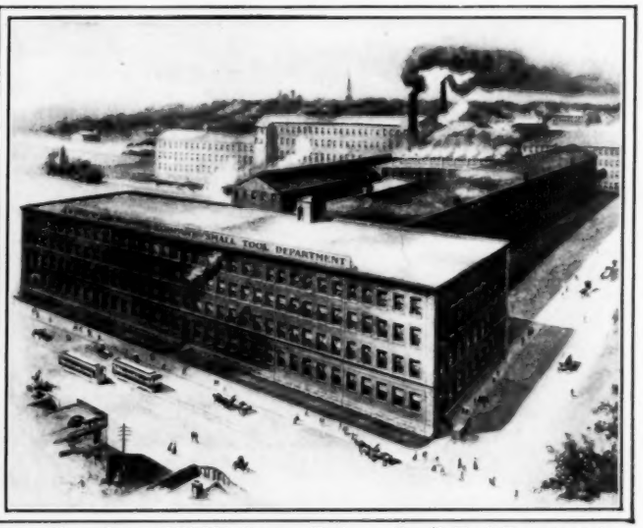

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Standard Taps, Reamers and Counterbores.

BY JOS. M. STABEL.

Herewith I send a few systematically arranged items for toolroom use. Table 1 gives a standard for fluting taps from ¼ to 2 inches in diameter, and also shows the proper radii for emery wheels used for grinding out the flutes. This table may not be approved by all, as the milling of taps is done with several different styles of cutters, but some standard should be adopted.

Diameter of Tap.	Number of Flutes.	Radius of Convexed Milling Cutter.	Depth of Flutes.
¼	4	3/32	.050
5/16	"	"	.062
⅜	"	1/8	.075
7/16	"	"	.087
½	"	5/32	.100
9/16	"	"	.112
⅝	"	3/16	.125
11/16	"	"	.137
¾	"	7/32	.150
13/16	"	"	.162
⅞	"	¼	.175
15/16	"	"	.187
1	"	9/32	.200
1⅛	6	7/32	.160
1¼	"	¼	.178
1⅜	"	"	.196
1½	"	5/16	.214
1⅝	"	"	.232
1¾	"	"	.250
1⅞	"	⅜	.268
2	"	"	.286

Depth of 4 fluted taps = Diam. of tap / 5

Depth of 6 fluted taps = Diam. of tap / 7

TABLE 1. STANDARD FOR MILLING TAPS.

Fig. 1 shows a standard set of proportions for machine reamers ranging from ¼ to 1 inch in diameter. The diameters and lengths can be computed by the accompanying formulas, while to make the matter as simple as possible a chart has been drawn for the lengths, which require no accuracy. This should be redrawn by the user full size. The lettered distances on the chart correspond to similarly lettered distances on the sketch. The left-hand vertical line, which stands for the length of the 1-inch reamer, should be drawn 10½ inches, while the right-hand vertical should be 3¼ inches long, and the two inclined lines which divide the other lines give the length of the reamer and of the flat on the shank.

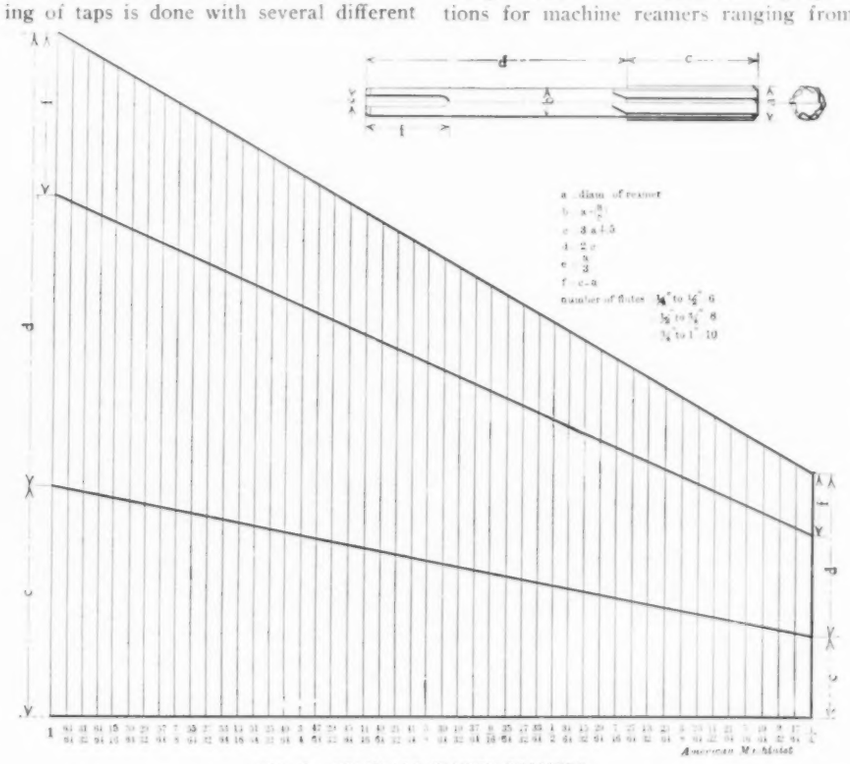
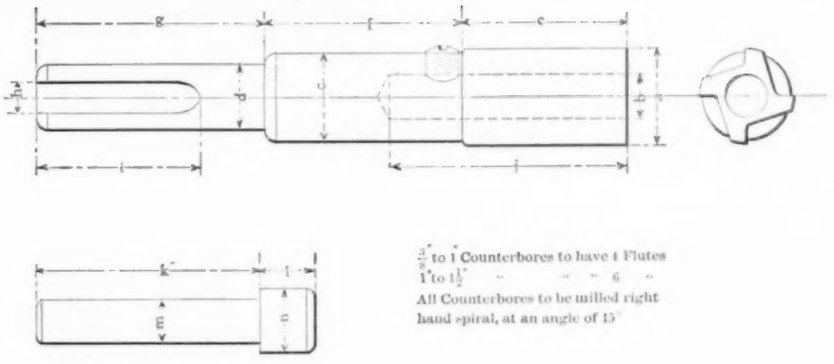


FIG. 1. STANDARD FLUTED REAMERS.

A line of adjustable pipe taps, which has been systematically arranged, is shown in Fig. 2. The range is from the 1-inch to the 4-inch standard pipe size, involving nine different sizes. The different parts were held as nearly to interchangeability as the sizes of the taps would permit. The sizes which are to be held throughout on all the taps are shown in their respective places on the drawings of the detailed parts, while those that have to be changed for different taps are marked with a letter, and these lettered sizes are in turn shown in the table at the lower right-hand corner.

The usefulness of this chart is shown by the fact that we have about three score



⅜" to 1" Counterbores to have 4 Flutes
1" to 1½" " " " 6 "
All Counterbores to be milled right hand spiral, at an angle of 15°

a	b	c	d	e	f	g	h	i	j	k	l	m	n
¼	7/16	21/32	1/16	1	1 1/16	1 1/8	5/16	1 7/16	1 1/4	1 7/16	1/4	5/16	From 3/8" to 15/16" in 32nds.
5/16	"	13/16	"	1 1/32	1 1/8	1 1/16	"	1 1/2	"	"	"	"	
3/8	"	15/16	"	1 1/16	1 3/16	1 1/4	"	1 9/16	"	"	"	"	
7/16	9/16	1 1/16	1/2	1 1/8	1 1/4	1 11/16	1/4	1 5/8	1 1/2	1 5/8	3/8	5/16	From 1" to 31/32" in 32nds.
1/2	"	1 1/8	"	1 3/16	1 5/16	1 3/8	"	1 11/16	"	"	"	"	
9/16	"	1 3/16	"	1 1/4	1 3/8	1 7/16	"	1 3/4	"	"	"	"	
5/8	"	1 1/4	"	1 5/16	1 7/16	1 1/2	"	1 13/16	"	"	"	"	
11/16	"	1 5/16	"	1 3/8	1 1/2	1 9/16	"	1 7/8	"	"	"	"	
3/4	"	1 3/8	"	1 7/16	1 9/16	1 5/8	"	1 15/16	"	"	"	"	
13/16	"	1 7/16	"	1 1/2	1 5/8	2	"	2	"	"	"	"	
7/8	"	1 1/2	"	1 9/16	1 11/16	2 1/16	"	2 1/16	"	"	"	"	
1	"	1 9/16	"	1 5/8	1 3/4	2 1/8	"	2 1/8	"	"	"	"	
1 1/16	1/2	1	1/4	1 7/8	2	2 1/8	5/16	1 11/16	2 1/8	2 11/16	1/2	1/2	From 1" to 1 15/16" in 32nds.
1 1/8	"	1 1/16	"	1 15/16	2 1/16	2 1/4	"	1 3/4	"	"	"	"	
1 3/16	"	1 1/8	"	2	2 1/8	2 5/16	"	1 13/16	"	"	"	"	
1 1/4	"	1 1/8	"	2 1/16	2 3/16	2 3/8	"	1 7/8	"	"	"	"	
1 5/16	"	1 3/16	"	2 1/8	2 1/4	2 7/16	"	1 15/16	"	"	"	"	
1 3/8	"	1 1/4	---	2 3/16	2 5/16	2 1/2	"	2	"	"	"	"	
1 7/16	"	1 1/4	"	2 1/4	2 3/8	2 9/16	"	2 1/16	"	"	"	"	
1 1/2	"	1 5/16	"	2 5/16	2 7/16	2 5/8	"	2 1/8	"	"	"	"	

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FIG. 3. STANDARD COUNTERBORES WITH INSERTED PILOTS.

or more of these taps in constant use on the hardest kind of metal, where high-speed steel is the only kind that will properly stand up to the work. With the aid of this sheet we are able to make repairs and renew the threaders without calling the tap out of service.

The construction of this tap is as follows: Referring to the assembled drawing at the top, the threaders *T* are a sliding fit in the body *B* and are collapsed by moving the handle *H* which is screwed into the center piece *C*, which has three cam-shaped slots milled in it, coinciding with the number of threaders. The spring *S* serves to retain the threaders in the slots when the center piece is turned.

To compensate for wear, the tap is provided with two different adjustments, of which the first is accomplished by the knurled ring *R*. This adjustment is used when the forward part of the threads is badly worn, necessitating grinding off the threaders, when the ring *R* is adjusted forward to serve as a backing for the threaders. The center piece, on which the threaders rest when at work, is turned to the same taper as the tap, which is a very important item, as by reason of it the diameter is not changed when this adjustment is made. The second adjustment is of equal value with the first and is accomplished by the adjusting screw *A*. It is necessary in adjusting the threaders to size. Turning the adjusting screw in and out gives an endwise movement to the center piece *C*, which, being tapered at its forward end, expands or contracts the threaders as the case may be.

Fig. 3 is a very handy chart for counterbores, a full set of which in the toolroom is a great help to the toolmakers. One great advantage of this construction is that the pilots are interchangeable to a certain degree. A ⅜-inch counterbore has five different changes of pilots, if they are made to thirty-seconds as the chart calls for, and for larger diameters of counterbore the range of pilots is greater. For instance, the 1½-inch counterbore has thirty-two changes, ranging from ½ to 1 15-32 inches. There are nineteen counterbores and sixty-four pilots in this list, from which 341 combinations can be made. That is, with nineteen tools and sixty-four pilots we have a range that would require 341 solid counterbores.

The counterbores are milled with a right-hand spiral at an angle of 15 degrees, and the cutting edges extend from the outer diameter to the pilot hole, thus permitting the counterbores to be used with pilots having diameters equal to the size of the hole in the counterbore.

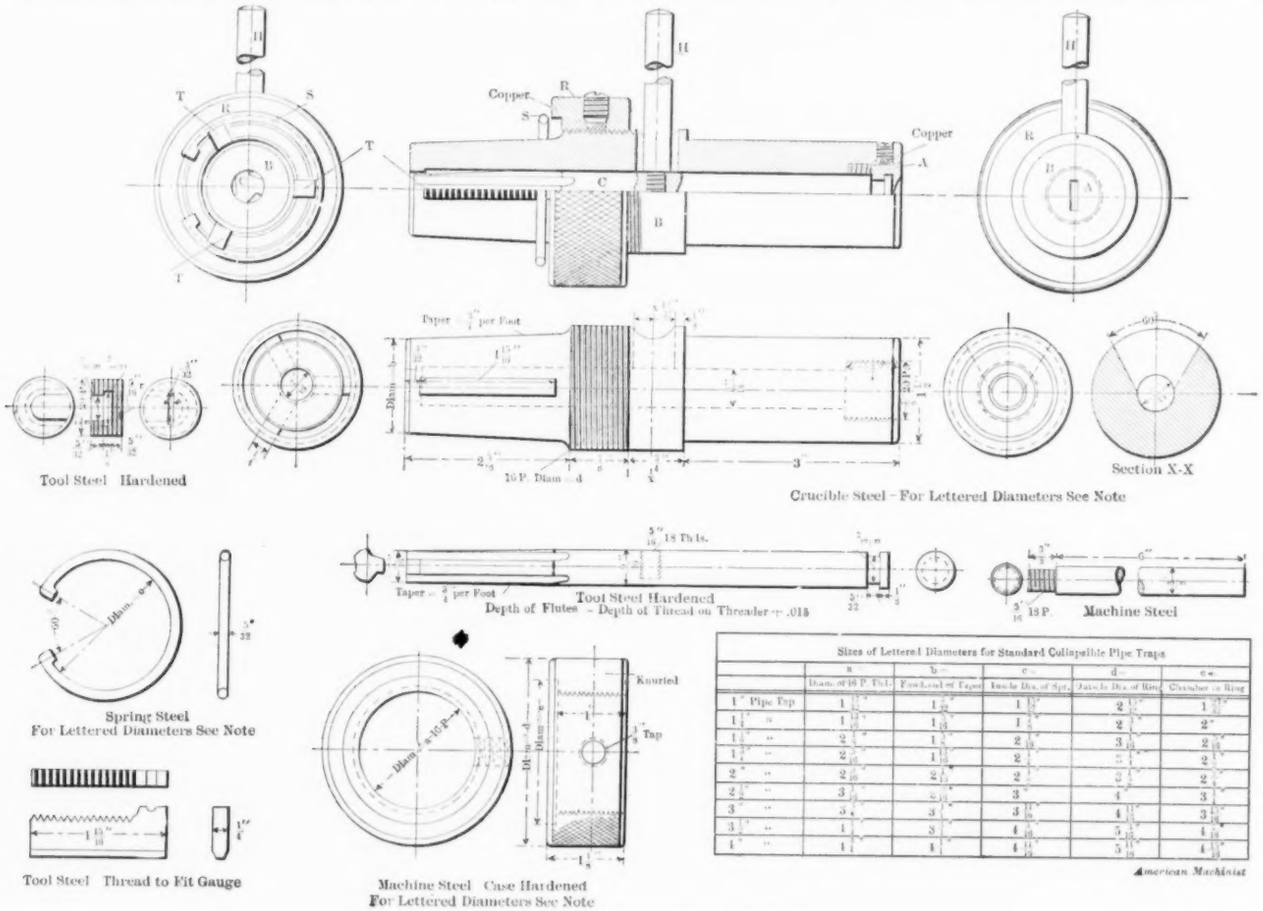
An English High-Speed Lathe.

The Tangye Tool & Electric Company, of Birmingham, England, has completed a 48-inch lathe for use with high-speed steel, which is probably the most powerful machine of its class yet constructed.

Cuts of 1 inch depth with a feed of ¼ inch and a cutting speed of 32 feet per minute, and of 1 inch depth with a feed of 1-10 inch and a cutting speed of 80 feet per minute have been taken, while the power absorbed has reached 65 horsepower. The machine was designed to remove a ton of chips per hour, but whether it has actually accomplished this task we are not informed.

A Micrometer Stop for the Lathe Cross Slide—A Correction.

Our attention has been called to the fact that in the description at page 21 of the above tool, the pitch of the screw and graduated nut given as 20 per inch should be 40 per inch instead.


Copper
Tool Steel Hardened
Crucible Steel – For Lettered Diameters See Note
Section X-X
Spring Steel
For Lettered Diameters See Note
Tool Steel Thread to Fit Gauge
Tool Steel Hardened
Depth of Flutes = Depth of Thread on Threader + .015
Machine Steel
Knurled
Machine Steel Case Hardened
For Lettered Diameters See Note

Sizes of Lettered Diameters for Standard Collapsible Pipe Taps

	a Diam. of 16 P. Thd.	b Pitch Line of Taper	c Inside Dia. of Spr.	d Inside Dia. of Ring	e Chamber in Ring
1" Pipe Tap	1	1	1	2	1
1¼ " "	1	1	1	2	2
1½ " "	2	1	2	3	2
1¾ " "	2	1	2		2
2 " "	2	2	2	3	2
2½ " "	3		3	4	3
3 " "	3	3	3	4	3
3½ " "	4	3	4	5	4
4 " "	4	4	4	5	4

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FIG. 2. STANDARD COLLAPSIBLE PIPE TAPS.

A Conical Hoisting Drum.

The accompanying illustrations show one of a pair of conical hoisting drums made at the Webster, Camp and Lane Division, South Akron, Ohio, of the Wellman-Seaver-Morgan Company. The drum will be seen to be 16 feet in diameter at the large end and 10 feet at the small end, the conical section being very flat and increasing from the small to the large diameter in four revolutions.

The mold was made by the sweeping

process, which is, however, complicated by the conical portion of the drum and by the further consideration that the disposition of the rope calls for several different axial pitches in the length of the drum. Fig. 2 shows the section of the drum in its relation to the sweeping apparatus. The mold was first swept to the inside profile of the drum and the core was then made in place to be lifted out and finished, after which the mold was swept out to the bottom of the grooves when the grooves were cut in the face of the mold.

Fig. 3 shows the provision for sweeping the conical portion of the mold. A long keyway *a* in the upper end of the spindle holds the gear *b* from turning but permits it to rise as the sweeping frame is turned

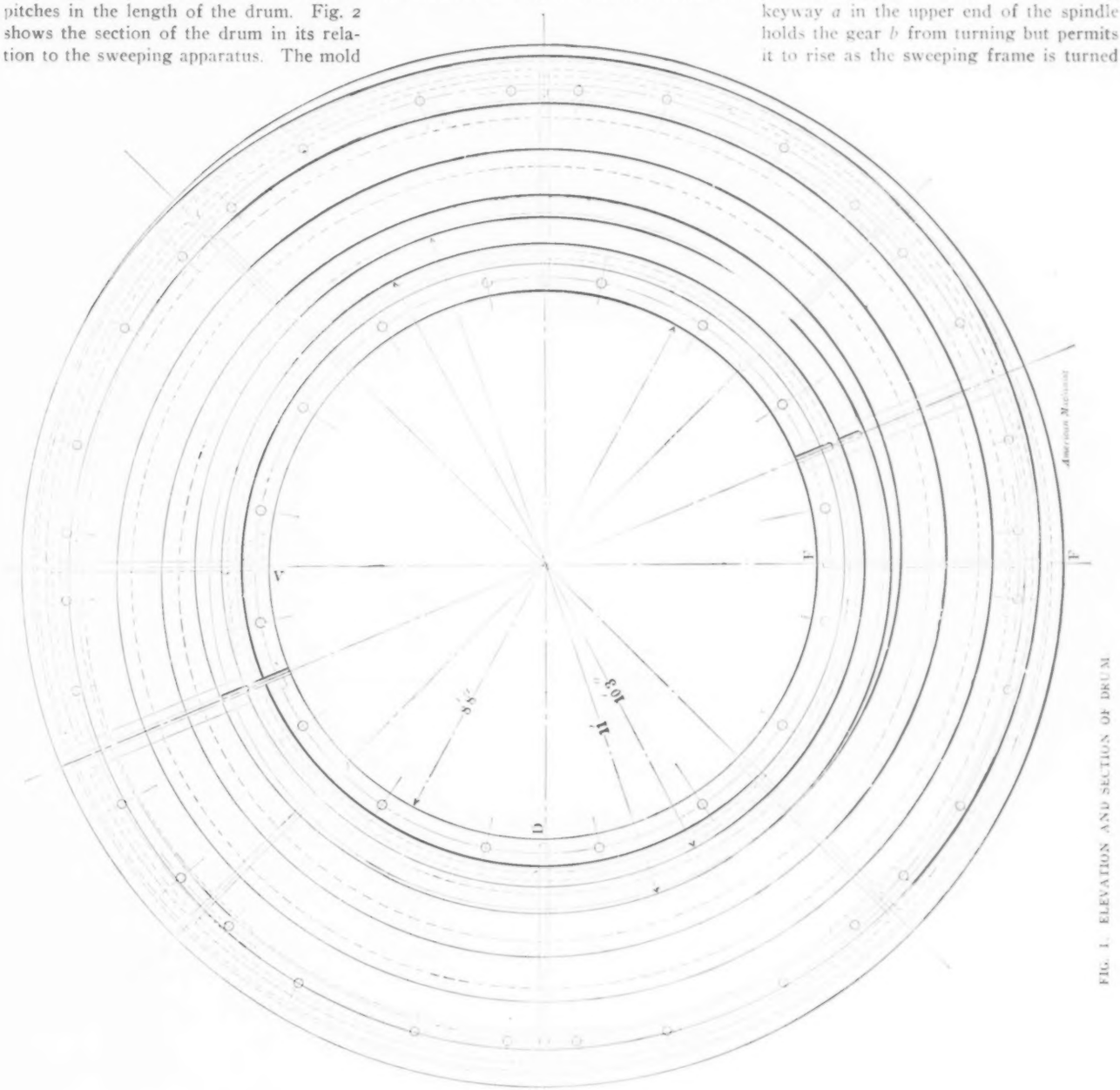
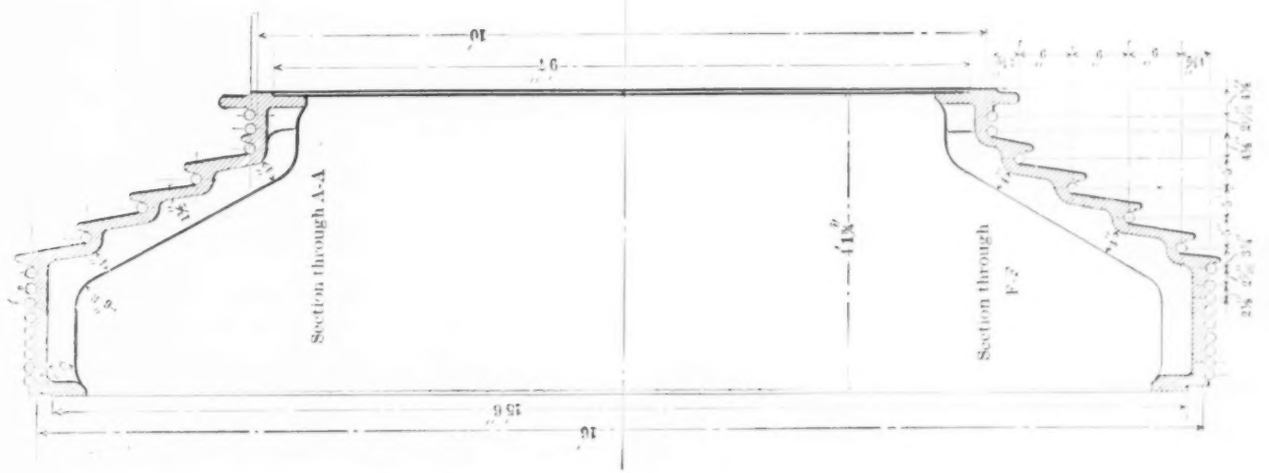


FIG. 1. ELEVATION AND SECTION OF DRUM



about the spindle. Gear *b* drives gear *c*, which, by means of shaft *d*, pinion *e* and rack *f*, causes the sweep arm *g* to travel radially as the frame is turned. The variations in the axial pitch of the drum grooves are provided for by a variable pitch thread cut in the spindle, as shown in Fig. 4, the pitch of this thread at each point corresponding with the desired pitch of the drum grooves. Engagement of the sweeping frame with this groove is by a roller bearing conical roller located at *h*, Fig. 3, and shown more fully in Fig. 5. M.

Hardening and Tempering Punches.

BY E. R. MARKHAM.

It is well known among hardeners that cylindrically shaped pieces of steel are more apt to cause trouble when hardened than those of other shapes. For punches which are to be used with dies to give satisfaction it is necessary that they be as strong as possible. This is secured by giving them the lowest heat consistent with good results when they are hardened. The heat will of course depend on the "temper" of the steel used.

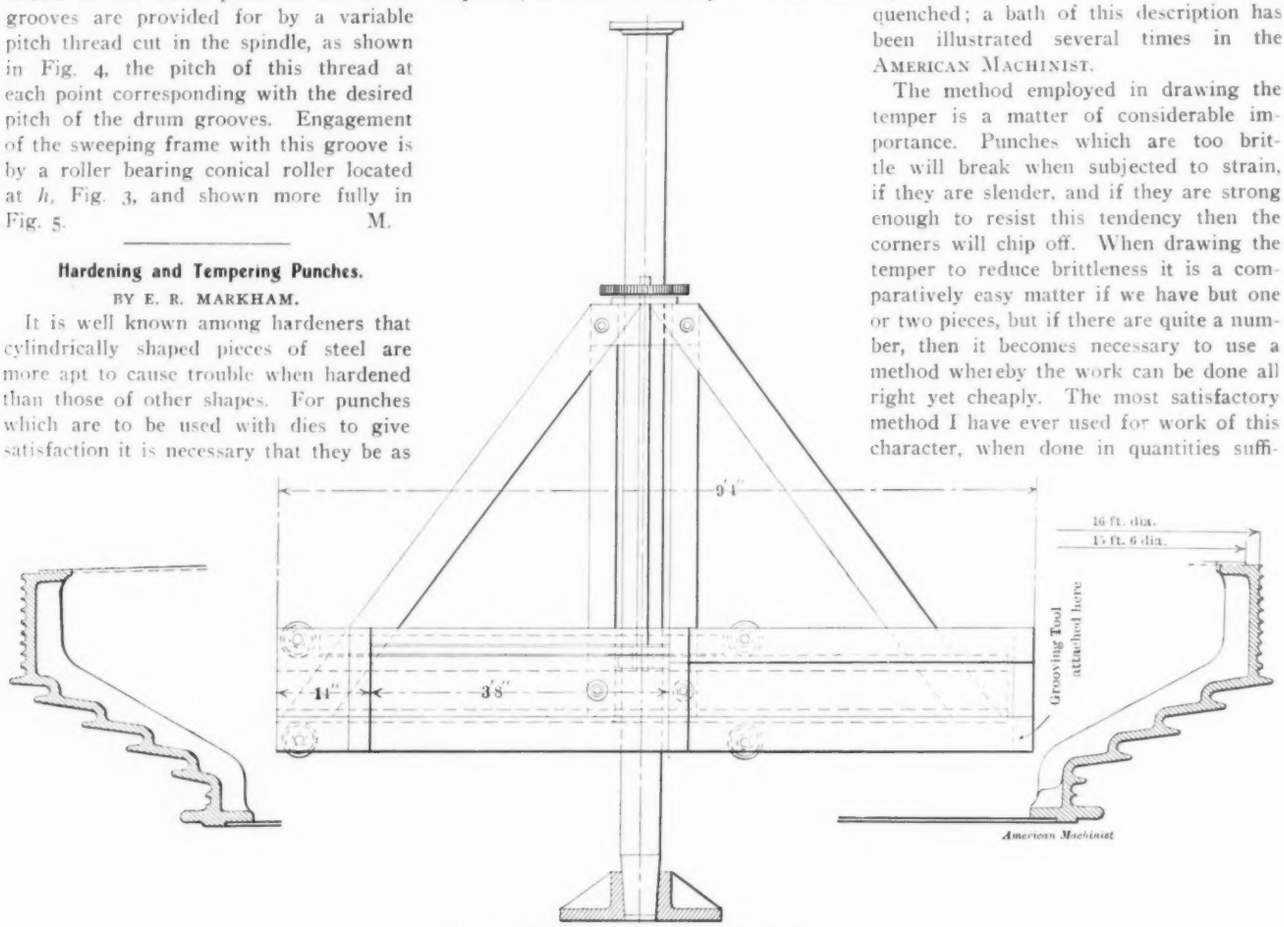


FIG. 2. DRUM AND SWEEPING APPARATUS.

temper as low. Being harder and stronger it will not be necessary to grind as often.

As stated, cylindrical pieces of steel are more apt to give trouble than pieces of other shapes when hardened, unless care cause the grain of the steel to be compact and the strongest possible. And not only is it stronger but it is also less brittle than if given a higher heat, and, as a consequence, it is not necessary to draw the temper as much.

It is not generally considered advisable to use a *high carbon* steel for this class of work. But whatever grade is used—unless it is a brand of high speed steel—harden at as low a heat as will secure the desired result, as in this manner we is exercised and the proper facilities are used; soft spots are apt to result, and this is a serious matter in the case of a punch. To avoid this difficulty it is necessary when hardening to work the punch up and down rapidly in the bath. A better method, however, consists in using a bath having several perforated pipes extending up from the bottom, these so arranged that water will be projected against the sides of the work being quenched; a bath of this description has been illustrated several times in the AMERICAN MACHINIST.

The method employed in drawing the temper is a matter of considerable importance. Punches which are too brittle will break when subjected to strain, if they are slender, and if they are strong enough to resist this tendency then the corners will chip off. When drawing the temper to reduce brittleness it is a comparatively easy matter if we have but one or two pieces, but if there are quite a number, then it becomes necessary to use a method whereby the work can be done all right yet cheaply. The most satisfactory method I have ever used for work of this character, when done in quantities sufficiently large, has been to heat the pieces in a kettle of oil over a fire of some sort, gaging the heat by a thermometer. It is necessary to leave the pieces of steel in the oil sufficiently long after it has reached the desired temperature to insure their getting as hot as the oil they are in.

A method used extensively in some shops is to heat the articles in a dish of sand which is agitated in order to produce *uniform* results. This works very nicely,

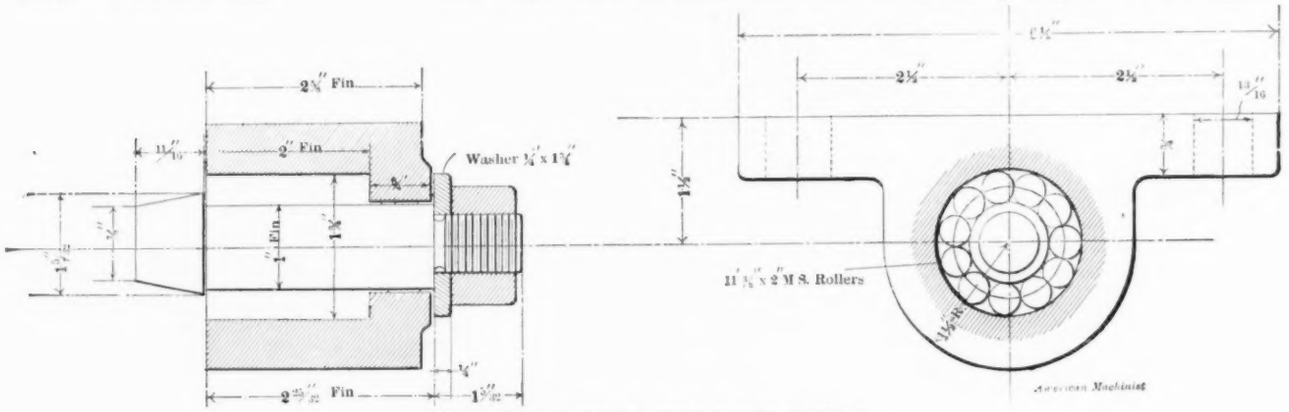


FIG. 5. CONICAL ROLLER WITH ROLLER BEARING.

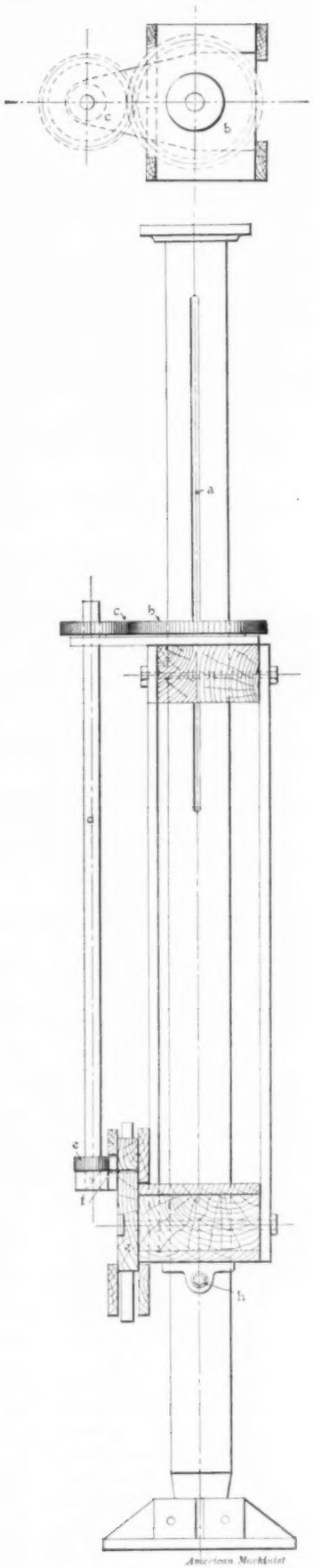


FIG. 3. ARRANGEMENT FOR SWEEPING CONICAL PORTION OF MOLD.

as the action of the sand tends to keep the surfaces bright so that the temper colors show clearly. If the heating is slow, the large and the small parts heat uniformly. Care must be used if the articles have sharp corners or other portions likely to be injured by contact with other pieces of steel. Instead of shaking the dish over the fire, it may be stationary and the pieces may be moved around in the sand with a stick.

Another method consists in heating for drawing the temper in a machine made for this very purpose. The work is placed in pans which are kept in constant motion and if the heat is applied gradually and uniformly, excellent results are obtained. A thermometer on the top of the machine allows the operator to govern the temperature to a nicety, for while the thermometer does not necessarily denote the precise temperature to which the pieces are heated, he can by noting the reading of the thermometer when satisfactory results are obtained, duplicate the results by heating to the same temperature and allowing the work to remain the same length of time. Then, again, the machine spoken of is provided with a door, and by observing the color of the pieces as they pass slowly by the opening the condition of the work may be observed.

Hot plates are often used, and when but a few pieces are to be tempered one may by exercising extreme care get good results, but oftener poor results follow, especially if the operator attempts to draw the temper as fast as it should be drawn.

If a plate is used, drill holes in it deep enough to let the punches in for a considerable distance, placing the shank end in the hole and drawing from that end. Do not attempt to reverse, or the cutting end of the punch will be too soft, especially around the corners.

Remember, however, that "tempering" is resorted to simply to reduce the brittleness to a point where the tool may be able to stand when in use. Hardening causes this brittleness, and the less the brittleness the less it is necessary to draw the temper. The higher the heat when hardening the lower it is necessary to draw the temper and the softer the piece is. Knowing this, exercise the utmost care in heating for hardening. Also avoid very cold baths, especially if the pieces are small.

The round-house as an adjunct of the railroad is so familiar in America that its absence is quite striking when other countries are visited. There is much to be said in favor of the rectangular engine-house operated with a transfer table. There is certainly much less waste of room in the stowage of the engines and the facilities for hoisting and transporting the parts and for the tools used in repairing are better with only parallel lines. The turntable and the round-house belong to the day of small things.

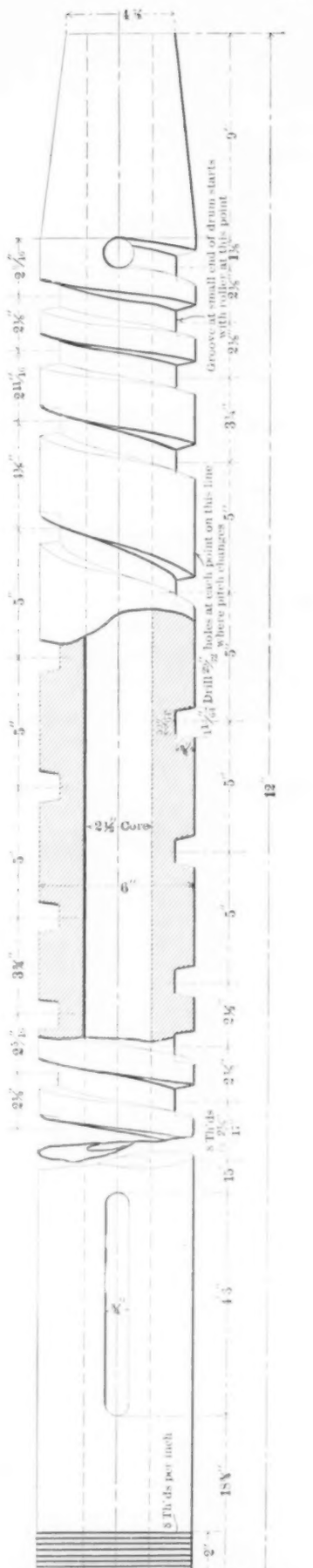

Groove at small end of drum starts with roller at this point
Drill holes at each point on this line where pitch changes
2½ Core
6"
8 Th ds per inch
8 Th ds per inch
12

FIG. 4. SPINDLE WITH VARIABLE PITCH THREAD.

Set of Jigs for a Manufacturing Operation.

BY L. O. DANSE.

Fig. 1 shows the steering connection knuckle of the Cadillac automobile. The piece is a drop forging having four machining operations. On casual inspection it looks like a very simple thing to machine; yet it has required quite a good deal of study to devise really satisfactory methods of manufacturing it, in which it resembles a large class of innocent-looking pieces to be found in the construction of various devil wagons.

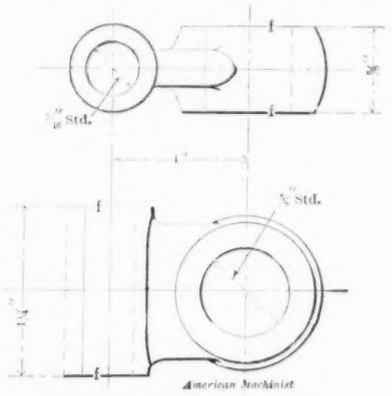


FIG. 1. THE WORK TO BE DONE.

Through the courtesy of Mr. Pollard, the superintendent of the Cadillac factory, I have been permitted to furnish the readers of the AMERICAN MACHINIST with a description of the methods adopted for doing the work, the illustrations being from blueprints furnished by Mr. Gates, the company's head draftsman.

From Fig. 1 it will be seen that there is a 5/8-inch reamed hole through the large, short hub and a 5-16 inch reamed hole through the long hub. While these holes are at right angles to each other, no great degree of accuracy is required in their angular relation, nor even in their center distance. The essential requirements are that the ends of the hubs shall be at exactly 90 degrees with the axes of the holes, and that the thickness, or rather length, of the hubs shall be exact.

The die in which the forgings are made is provided with a tit, which produces a starter or depression in one face of the short hub for centering the drill. The presence of this starter led to the decision that no bushing was required in the jig to guide the drill, and that the drilling of this hole should be the initial operation.

The shape of the piece is such that it is scarcely amenable to the usual methods of holding in a jig, and the presence of a none too well trimmed fin had to be considered in designing a suitable jig for the first drilling operation.

Fig. 2 shows how the problem was solved. The piece is pushed by a cam-actuated clamp *a* against a hardened tool-steel V-block *b*, while the thrust of the drill is taken by a hardened bushing *c* of such diameter that the drill can pass through it without danger of touching. To eliminate the possibility of trouble from the fin on the forging, the V-block *b* is cut away so as not to come in contact with that portion of the forging which comes at the parting of the die. To insure the correct placing of the forging in a horizontal plane, the clamp *a* is also provided with a V-notch which constrains the work to its proper position. There are thus four actual points of contact on the V-block and two actual ones on the clamp, the relation of these actual points being such as to produce three virtual holding points, and hence to insure the steadiness of the work while being operated upon.

It will be noticed that the cam is fulcrumed in a yoke *d* which passes around the body of the jig and is fitted with a set-screw *e* and check nut at the left-hand end. This permits a ready adjustment of the cam pressure and overcomes the greatest drawback to the use of that most convenient and rapid clamping device. A spring, not shown in the drawing, forces back the clamp when the cam is released.

After the drill has passed through the piece and been withdrawn, a machine reamer is run through the hole, the change from drill to reamer being made without stopping the press, by means of a slip socket.

The next operation is the drilling and reaming of the 5-16 inch hole, which is performed in the jig shown in Fig. 3. It will be noticed at once that this jig closely resembles the previous one in the manner of holding the work, having again a V-block *a* for locating the forging. This V-block is cut away so as to hold the long hub by the ends only.

The clamp *b* has two slots milled across it, one horizontally and one vertically, in such a manner that the hub containing the 5/8-inch hole is caught at the intersection of the slots and held by the four sharp corners produced by their intersection, clear of the fin. Here again we have an arrangement giving us three virtual points of contact with the work and eliminating all tendency to rock. The quick-acting cam with yoke and set-screw adjustment is similar to that shown in Fig. 2.

The drill bushing *c* is provided with a handle *d*, made of drill rod, whereby it can be lifted out of the bushing plate to admit the machine reamer. As was the case with the previous jig, the change from drill to reamer is made without stopping the press. A stop-pin, in the bushing plate, against which the handle of the bushing engages, prevents the bushing from rotating with the drill.

Having completed the drilling and reaming, the facing remains to be done. Two methods of doing this were considered: sweeping off with counterbores and milling. The latter was selected as being less liable to inaccuracy in length, and the jig shown in Fig. 4 was designed for the third operation—facing the short hub. This jig is a "double ender," and consists of a base *a* with tongue and lugs for bolting to the platen of the milling machine, and of the revolving body *b*, which is secured to the base by means of a vertical trunnion and a clamping bolt *c*.

Twelve pieces can be held at each end of the jig, the object being to permit changing the pieces at one end while operating on those at the other. The only loss of time is, therefore, that involved in running back the table and revolving the jig about the trunnion so as to bring a fresh end into position for use.

A 3/4-inch hardened tool steel pin *d*, flattened on two sides to 1/2 inch and driven into the base, serves as an abutment against which the rounded point of a headless screw *e* in the revolving body brings up when the latter is in a correct working position. Each of these headless screws is provided with a check-nut to lock it after it has once been properly set. As a precaution against their being tampered with, these two stop screws are made of such a length that their slotted ends come about 3/8 inch inside of the jig body, and a short headless screw is put in behind each to fill up the space to the

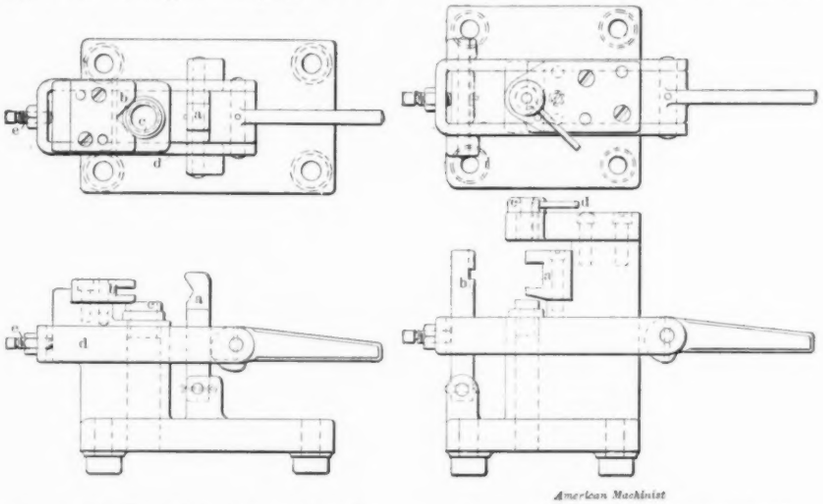


FIG. 3. JIG FOR DRILLING SHORT HOLE.

FIG. 3. JIG FOR DRILLING LONG HOLE.

back of the jig. It is evident that the application of a screw-driver to this short screw would fail utterly to affect the previously made adjustment of the stop screw. These short screws also act as supplementary checks to the stop screws.

The stud *f* for clamping the revolving body to the base is tapped into the latter, while V-shaped recesses in the former are provided to embrace the stud. A helical

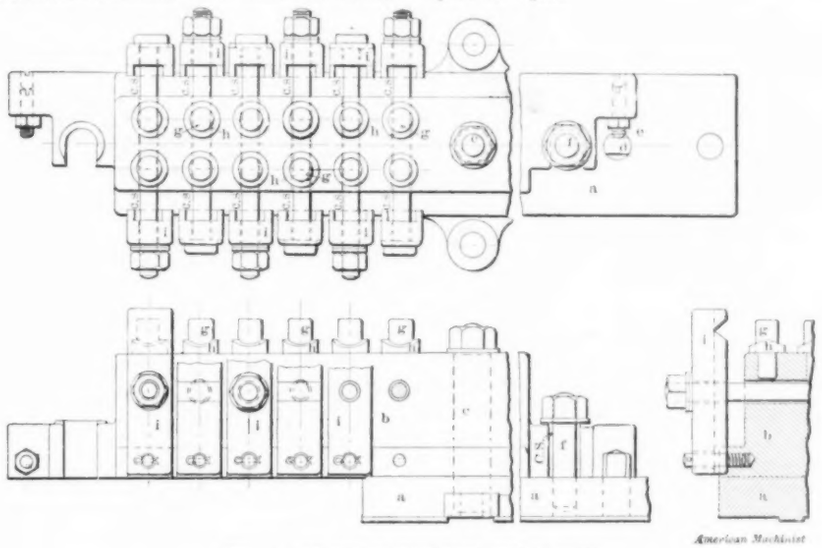


FIG. 4. JIG FOR FACING THE SHORT HUB.

spring, surrounding the stud holds the washer up against the nut when the latter is slacked to admit of revolving the body.

The trunnion *c* is 1 inch in diameter, driven into the base and riveted over at the bottom; while the revolving body is a good free fit on it. Just below the top of the body, the trunnion is shouldered down to ⅝ inch, so that a nut and washer of this size can be used to assist in clamping down the body. As the clamping stud is ⅝ inch, the same wrench fits both trunnion and stud nuts.

In order to insure perpendicularity of the milled face of the work with the reamed hole, the latter is used as a locating point, and the top of the jig is provided with pins *g g g* for the pieces to be held at one setting.

Each piece to be operated upon is pushed down over its pin until it comes into contact with a hardened steel collar *h* fitted on the pin. In order to reduce to a minimum the probability of trouble from chips lodging between the work and and the collars the latter are milled off very much like the roof of a house, so that the work rests on the edge corresponding to the ridge of the roof, and any chips that may have been overlooked are most likely to be pushed down the sloping surfaces out of the way.

The clamps *i i i* for holding the work are let into vertical grooves in the jig body to insure their axes remaining at all times in the same plane with the axes of the locating pins. The clamps are milled away in such a manner as to bear only near the ends of the long hubs of the work, in a manner somewhat similar to that in which the V-block held these hubs while they were being drilled in the jig shown in Fig. 3. The two bearing points of the clamp, pushing against the snugly fitting locating pin, give the three-point bearing effect which is necessary to prevent rocking of the work while being operated upon.

It will be noticed that the clamps are in pairs on bolts passing loosely through the jig body, so that setting up one nut tightens two clamps, diminishing by one-half the time required to do the clamping and unclamping. The bolts have round heads, milled with tongues on their under sides which enter grooves in the clamps to prevent the bolts from turning with the nut.

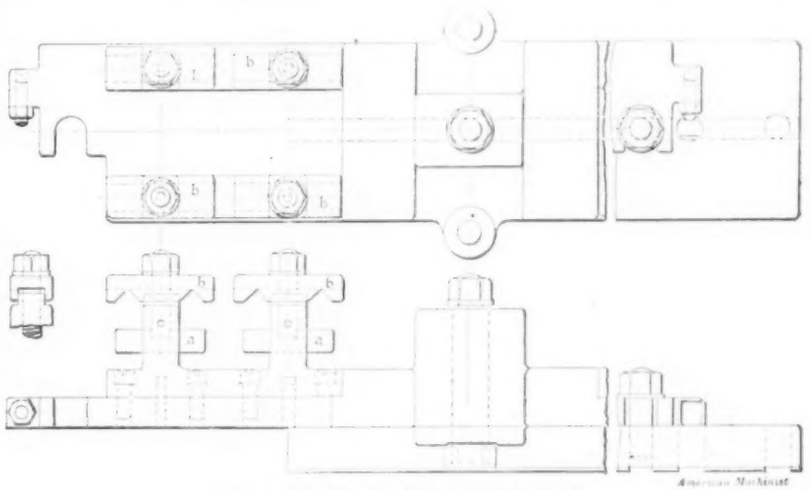


FIG. 5. JIG FOR FACING THE LONG HUB.

Springs *c s* hold the clamps away from the work when the nuts are loosened.

When the milling of one face of a lot of pieces has been completed, the table of the machine is raised and the other faces are then milled on the same jig.

Chips which may drop down between the body of the jig and the clamps can readily work out at the bottom without affecting the action of the clamps.

The final operation on the knuckles is the straddle milling of the ends of the long hub. The jig for this operation is shown in Fig. 5, and, like the one just described, is a double ender. In this case, however, only four pieces can be operated on at a time.

The knuckles are slipped on to horizontal pins *a a*, which fit the holes in the short hubs which are held to the pins by V surfaces on the clamps *b b*. A longitudinal groove in each clamp accomplishes a dual purpose: First, it cuts away the V in a manner similar to the V in the jig in which the hub to be operated on has been drilled, giving a similar hold relatively to the hole through this hub, which is necessary in order to bring the faces at right angles to the hole. Second, the groove fits over a tongue on the jig, which keeps the clamp parallel to the locating pins and prevents its turning around into the path of the straddle mills.

For convenience in machining, the portions of the jig which carry the work are made separate from the body and secured thereto by means of screws and dowels. Machine steel is used for these parts so that they may be sufficiently lightened.

In this fixture, as in the previous one, the clamps are so arranged that each nut controls two pieces, to reduce the labor of clamping to a minimum. A small counterbore around each clamp stud, not shown on the drawing, permits the introduction of a light spring to hold the clamp up against the nut.

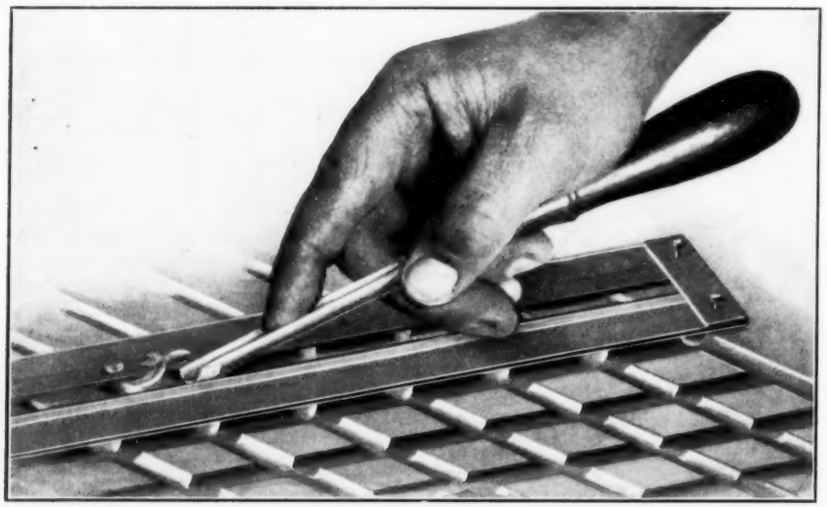
This entire set of jigs was designed to replace a set previously in use which failed to give satisfaction owing to the neglect on the part of the designer to provide for various contingencies inseparable from the production of accurate interchangeable work; and they appear to meet the requirements of modern manufacturing conditions which may be summed up as cheapening the product by improving its quality.

Letters From Practical Men.

Making a Checker-Work Pattern.

Editor American Machinist:

An article at page 33 reminds me of the way a patternmaker of my acquaintance made a somewhat similar pattern for a checkered foot-plate. In this case the checks were diamond shaped, flat on top with a round-bottomed groove between. As these grooves ran obliquely across the grain of the wood, a gouge would cut smoothly enough on one side, but on the other it would be cutting across the grain and would splinter up, especially in cutting the second set of grooves at an angle of 60 degrees with the first. He took two straight-edged pieces of sheet brass about 18 inches long and 1 inch wide, beveled one edge of each and fastened them together at both ends with the beveled edges facing each other, thus forming a slot equal in width to the groove to be cut. He then fastened this down on the pattern where the groove was to be, using a few small brads. With an outside ground gouge of the proper curvature he cut the grooves through this slot by holding the tool at such an angle that the cutting edge would reach into the wood, while the beveled sides of the gouge would bear on the brass. Thus the templet would be holding down the surface at the very instant when the gouge would be tending to splinter up the grain. In using this device it is not necessary to lay out the grooves all over the pattern; just mark the centers and pin on the templet. The width of the slot fixes the width of the groove and the curvature of the gouge determines the depth. W. H. S.



MAKING A CHECKER-WORK PATTERN.

Cutting a Checkered Plate Pattern.

Editor American Machinist:

At page 33 Mr. J. L. Gard shows a method used in cutting a checkered floor plate which recalls a similar piece of work done with a circular saw.

In this case the checks to match others on hand had to be ⅛-inch flat on top with spaces also ⅛ inch on top and 60-degree V-grooves, Fig. 1. About 40 feet of it was required for the several patterns and doing it by hand or planing it would be a long operation, so the time saved by sawing would more than compensate for the cost of rigging up the saw bench and give us a much more accurate piece of work when completed.

Two rip-saws of the same diameter and number of teeth were placed together on one arbor, with teeth alternating. The outside edge of each saw was ground to the proper angle and then the teeth were filed sharp. A 2-inch board 18 inches wide was planed for the temporary table *A*, Fig. 2. The hardwood strip *X* was let into the top for a guide with the sides beveled to 60 degrees to match the V-groove the saws would make.

The sliding table used in connection with the gate for the cross-cut was removed to allow this temporary table to be bolted to the saw bench. The gate *B* was made to slide on top of the table *A* for the cross-cut, pieces *C C* acting as guides to keep it square.

Pieces 2½ inches thick and 3 feet long were used to start with, making checks on both sides and sawing them off about ½ inch thick, thus getting four pieces from each 2½-inch piece used.

There is one disadvantage in *sawing* the checks—that is, the corners are liable to chip off; but by making the cuts across the grain first and then lengthwise this trouble is avoided. After getting the saw rigged, it took about two hours to saw out the work. C. FREMONT.

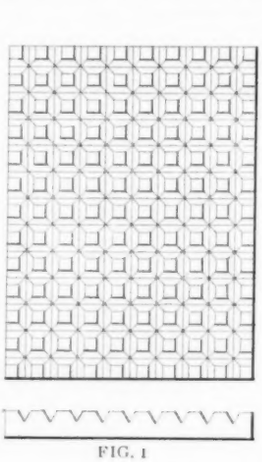


FIG. 1

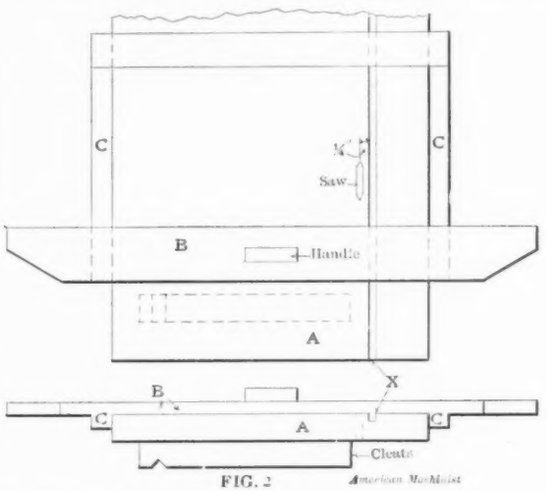


FIG. 2 *American Machinist*

RIG FOR SAWING A CHECKERED PLATE.

Steady and Follow Rests.

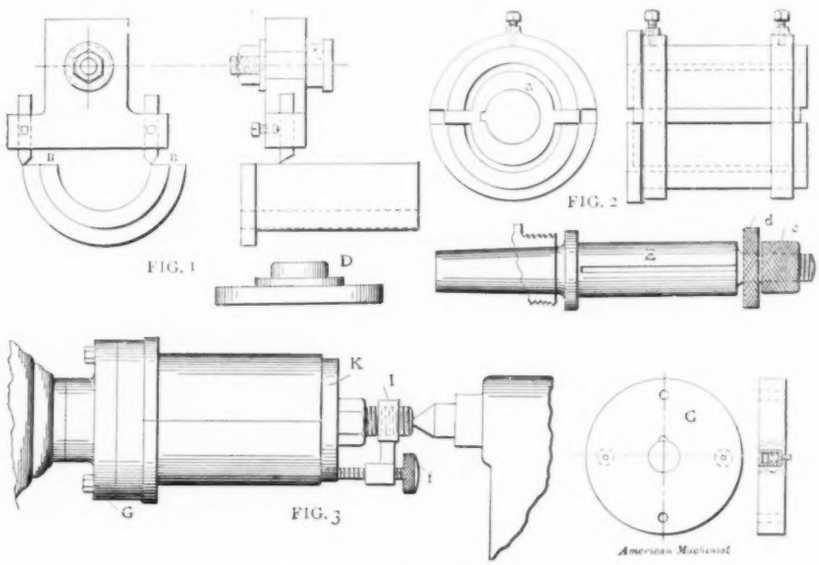
Editor American Machinist:

We once had a job that required a steady-rest, yet did not have stock enough to true up without cutting through, and a cat-head could not be put on on account of some projecting horns; a ring of babbitt was cast around it in a wooden mold, and after this was turned up, the rest was easy.

I think if follow-rests were better understood they would be used much more than they are for turning short shafts, etc.; but when they are not properly used or understood, it is surprising how a man can turn a job nearly square or many-sided without at all trying to do so, and in fact when trying his best to avoid it. A good lathe hand will never attempt to use a steady-rest until he has the job spotted down or turned perfectly round, because the jaws do not have full contact with the shaft, and any irregularity at this point will appear when the other and adjacent parts of it are turned up. If, however, it were possible to clamp a stationary collar in the steady-rest and the hole was truly cylindrical, it would be possible to turn up a square shaft in this collar, providing the corners of the shaft ran true and did not fit or wear loose in the collar. With a follow-rest, however, the cut must be started dead true and the jaws kept up to the shaft if they wear, otherwise when the tool strikes a hard

spot or heavier cut, the shaft will spring away from the tool and leave a hump, and when the hump hits the jaws the shaft will be pushed into the tool, which leaves a hollow; and if this performance is permitted to go on, it gets rapidly worse, and the result is a waster. To do a good job with a steady-rest it is best to have the jaws fit a considerable portion of the circumference of the shaft, as the tool leaves it, but not necessarily the finished size unless the shaft is finished at one cut. The jaws can best be fitted by screwing them down on a reamer or boring bar of the proper size running on the centers. If this is done, the job will approach the condition of the square shaft in a collar, and if ordinary care is used in keeping the jaws in contact, satisfactory work will be turned out regularly. To facilitate the adjustment of the jaws I put wings on the set and cap-screws by slotting the heads and brazing in a piece of thin stock. Speaking about wrench sizes of lathe parts, why not use thumb-screws on the steady-rest jaws? and why need a change gear be fastened with a nut at all?—a little spring catch ought to hold on any gear, and that is all that is required.

GEO. J. MEYER.



MACHINING HALF BEARINGS.

Machining Half Bearings.

Editor American Machinist:

The sketches show a method of machining bronze boxes cast in halves. The castings are first clamped in a chuck on the shaper, and Fig. 1 shows a tool-holder used for facing both edges of the casting at once. The holder is clamped to the clapper of the shaper by bolt *A*, which takes the place of the usual tool-post. The tools, which are of ⅜ inch square steel, being properly set, are made to plane the bearings on faces *B B* simultaneously.

Fig. 2 shows a fixture on which these bearings are then clamped by the two ring clamps. To center the bearings the fixture *a* is set upon end over block *D* and the half boxes on each side of it, which admits of equal clearance when facing the opposite ends. The fixture *a* with the half bearings clamped thereon is then placed on the arbor *E*, which is held in the taper hole in the lathe spindle, the tailstock being kept back out of the way, as there is no other support required. Slip-washer *d* is put in place and lightly clamped by knurled nut *c*, the outside of which is smaller than the hole in *a*. The ends of the bearings are then faced to the required length.

Fig. 6 shows the fixture on which these bearings are turned, the tools being held in a turret tool-post which has been previously described. Two cuts are taken, roughing and finishing. *G* is a plate fastened to the lathe face-plate as shown, and into which the stud *H* is screwed a tight fit, being secured by a little pin driven in the end. The sides of the two dowels are located on the center line, and they are held forward by springs, as shown.

The flange of one of the half bearings is set against plate *G*, and the planed faces *B B* are set against the sides of the dowels. The knurled screw *f* is tightened and holds this half bearing in place. The other half bearing is now put in place, the spring dowels receding. Slip-washer *K* is slipped over stud *H*, straddling the point of screw *f*, and is tightened with the nut, as shown. The bearings are now held in a central position and ready to be turned. The arm *I* in which screw *f* is located is a tight fit on stud *H*, revolving with the lathe, and in no way interferes with the turning tools.

After the turning of these bearings they are bored in a horizontal boring and drilling machine. Two cutters are located in the boring bar at a distance apart which allows the finishing cutter to begin to cut as the roughing cutter leaves the hole.

C. S.

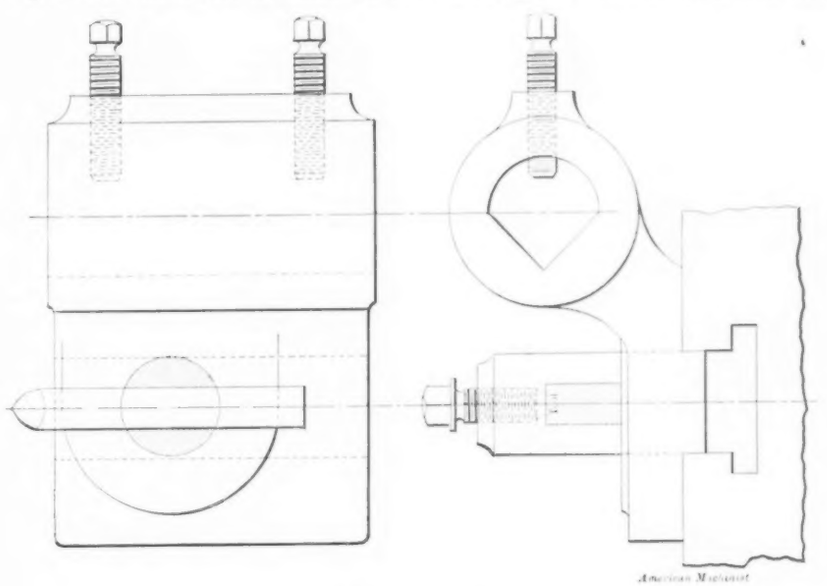
A Boring Tool Holder.

Editor American Machinist:

At page 16 Mr. Osborne describes a very useful tool-holder which surely has some good features. With the same feeling that Mr. Osborne has I wish to describe a tool-holder which is used for the same purpose, but differs from the one described by Mr. Osborne.

As shown by the sketch, this holder requires no special bolts or clamps, as it is slipped over the tool-post and is held down by a facing tool which can be used in combination if desired. One can also use any size of boring bar, straight shank drill, tap or similar tool (up to the size of the opening). No bushings are required, the bar being always brought to the proper hight.

LOUIS DELIVOUK.



A BORING-TOOL HOLDER.

Extension Die Holders—A Tool Room Rack.

Editor American Machinist:

We don't remember ever deriving so much practical benefit from any little simple thing as when we made the extension holders for a lot of solid dies we had left on our hands when we adopted the self-opening threading dies. The dies were of the ordinary round-body type, split down one side for the point of a screw to spread the die open and spotted on opposite quarters for screw points to press the die together. The holders were made as per Fig. 1, about 10 inches long, with about ¼ inch thickness of shell all around. A cross-hole near the end for a piece of ⅝-inch cold-rolled to turn it with, completed the outfit. We made a holder for each size and, as also shown in the cut, a couple of strips of sheet brass screwed to a post made a convenient rack to hold them. They are used on the erecting floor on any stud that gets banged or burred. Being hollow, they take in the longest gland stud and are long enough to allow free turning when the studs are close together. They are very popular with the floor men, and we could not get along without them. There is an occasional spot where we can't use them, and for such places we have a solid die of the exact size of the nut to be used; but that is dead slow.

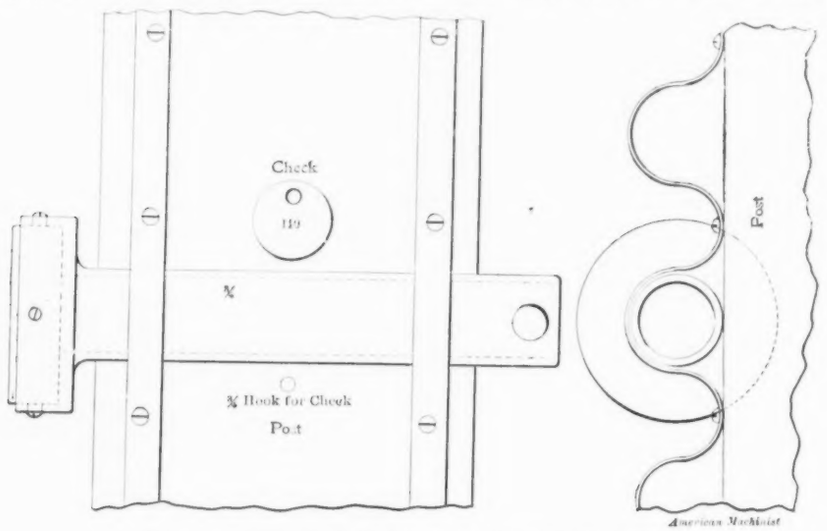


FIG. 1. EXTENSION DIE-HOLDER AND A TOOLROOM RACK.

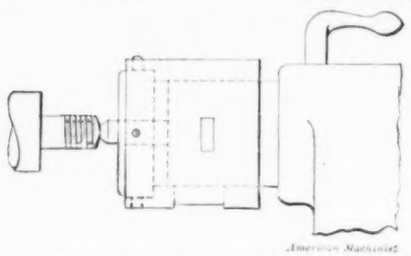


FIG. 2. DIE-HOLDER FOR TAILSTOCK.

Fig. 2 shows another place to use these same dies on a lathe for threading on the end of a piece of work. The shell fits the tail spindle, has a hole in the bottom for the chips to fall out and a slot inside to fit a tool held in the tool-post. In this way the die can be started on and backed off by moving the carriage.

ISAAC MORGAN.

Helping Yourself Along.

Editor American Machinist:

Since there is some probability that we are not always going to be able to recognize a workman by "his chips," it may be well to look for other marks by which he may be known. The introduction of high-speed tool steel has undoubtedly worked wonders in the machine shop; yet it is readily seen by examining the various reported tests of it that it may be a long time before practice is fixed for the lathe or planer hand who uses it, and while machine tool construction is undergoing changes, the most important of which, perhaps, will be increased belt power, the millions of machinists on their old lathes (which rarely wear out) will be going on with their varied notions as to what *is* proper as to speed and feed. Of course on these old tools the highest speeds must be secured by comparatively slow feeds; so that the man who prefers less speed has the advantage of using more feed. The character of the chips will be quite dissimilar, yet the amount of stock removed in a given time may be practically the same.

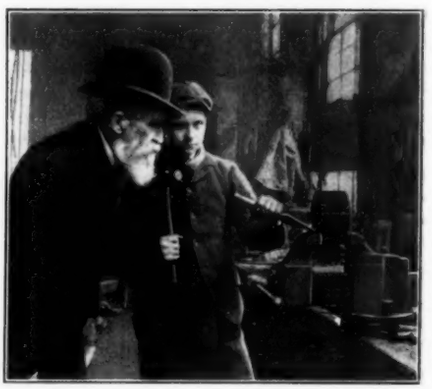
Among the many accomplishments which constitute the marks of a good workman, we would name that of his being able to shove a file in a straight line. A machinist who does not possess this art can hardly be styled an all-round man, and many a one on going into a new shop finds that this is the rule by which he is measured, and by it possibly found wanting.

Not long ago an applicant for work came to the foreman of a toolroom, where it was understood a good man was wanted. It was something of a surprise to him to be rejected. He could only surmise that the foreman considered him incompetent to fill the place, and acting on this belief he ventured to say, "I believe that I can come pretty near shoving a file straight." The foreman seemed surprised a little by these few words so fitly spoken, and turning to the applicant he said, "You may come to work in the morning." It being near the close of the week, the stranger preferred waiting until Monday, but nothing would do but to come in the next morning, which he did, and the man and the place proved very satisfactory.

Many of us can remember when the hammer and chisel did the work now performed by shapers and planers; the dexterous use of these simple tools was then, and still may be regarded as an accomplishment, and although their uses have been so restricted, they are still indispensable and will ever render valuable service.

In the old-time job shop, bench work consisted chiefly in chipping keyways and fitting keys, and the ambition of the apprentice was to secure work of this kind, for it really was no mean thing to be able to do this expeditiously and well.

The photograph shows an apprentice cuting his first keyway. This boy, like many in these days, had grown impatient at not being advanced as rapidly as he thought he should have been; yet he made no complaint, but, taking advantage of the absence of the foreman one day, he picked up an old wheel hub and proceeded to chip a keyway in it. About the time it was finished, along came the boss.



HELPING YOURSELF ALONG.

"What are you doing, John?" he inquired.

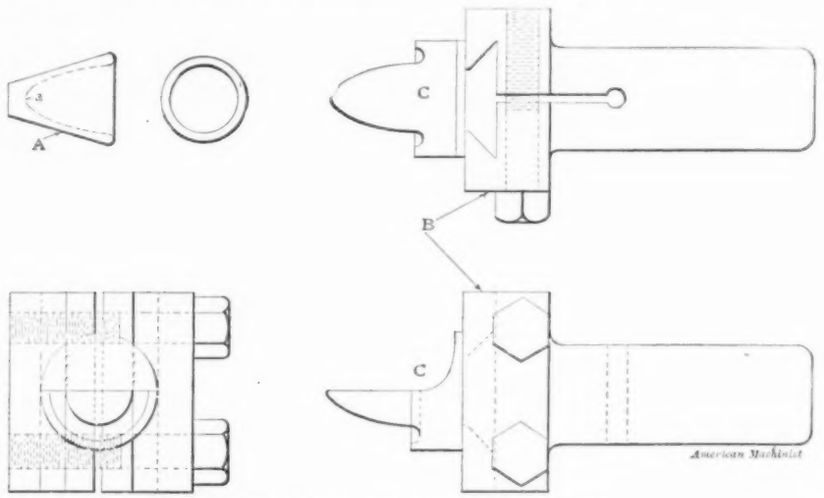
John moved away a little, so that his work might be examined, and he said in a somewhat significant tone of voice, "I have never been allowed to chip a keyway, and I had nothing else to do, so I thought I would try to chip one."

"You have done very well," said the boss. "Go on and keyseat that pile of pinions."

Of course John was much pleased in being able to use his hammer and chisel to a better purpose.

Apprentices in these days may learn a lesson from John's method of "kicking"

against grievances, whether imaginary or real. The boy who makes the interests of his employer his own, and manifests a disposition to learn, will not lack promotion or fail to acquire the essentials of a good workman. John finally became general manager of the works. QUIRK.



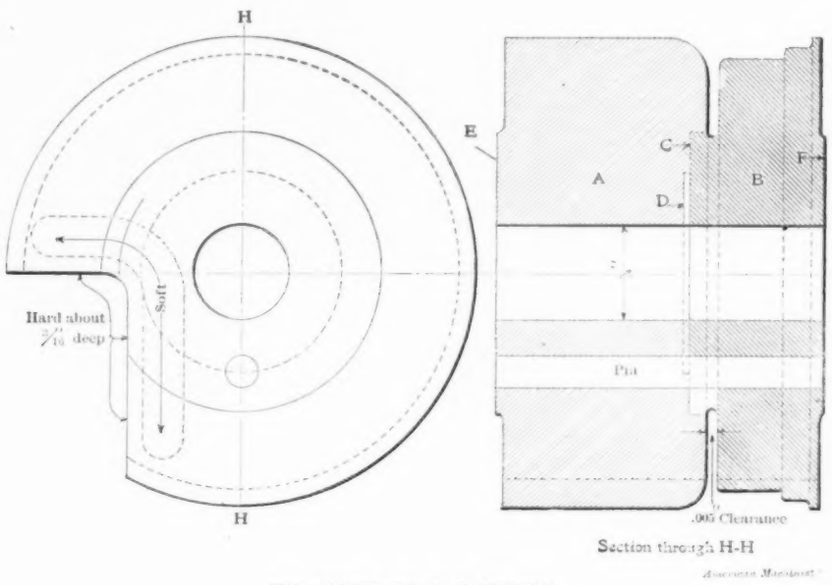
INSIDE FORMING TOOL FOR SCREW MACHINE.

Making a Circular Cutter in Two Parts to Facilitate Hardening.

Editor American Machinist:

Herewith is a sketch showing a circular cutter that gave me much trouble in hardening when made from one piece of steel, the portion enclosed by the dotted line always coming out soft.

To harden, I tried cold water, solutions of all kinds, and bone meal; the latter I heated in a Brown & Sharpe furnace. The result in each case was as stated; the cutter was hard all over, excepting the dotted line portion, which took on a surface hardening about 3-16 inch deep. Grinding soon took this 3-16 inch off, leaving the cutter soft at this point. The reader may suggest rehardening. That is one way out of it, but a very poor one, as frequent rehardening does not help the steel, and the cutter soon loses its shape.



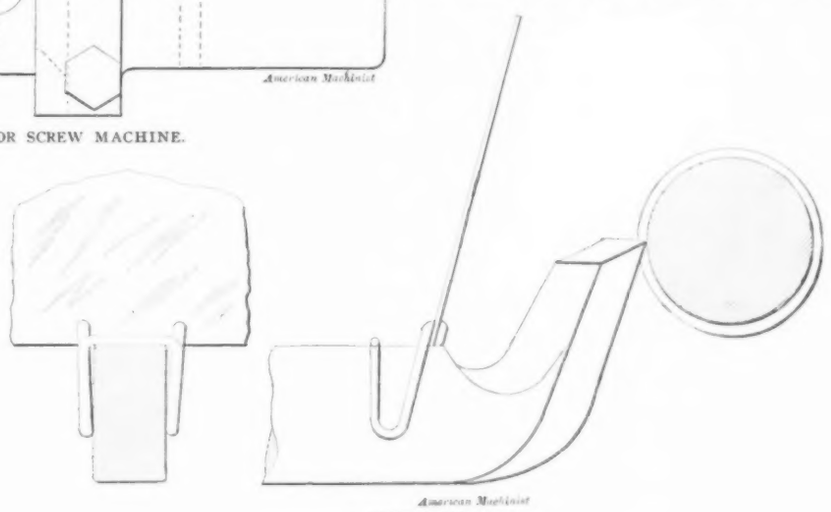
THE CUTTER TO BE HARDENED.

To overcome the trouble, I made a cutter, as shown, in two pieces *A* and *B*. This scheme worked well, and the hardening gave no further trouble. *A* is bored out at *C* to receive a hub on *B*, and to insure a good fit after hardening I bore out about 1-32 inch at *D*. The ends *E* and *F* are knurled to prevent the cutter from shifting after it is clamped in its holder. *G* is a pin which prevents any shifting when setting. A bottom clearance of about 0.005 inch is provided between *A* and *B* to prevent friction. G. D.

Inside Forming Tool for the Screw Machine.

Editor American Machinist:

Here is a sketch of a screw machine tool that I think will help some reader along with his work. It was made to finish the inside of the brass thimble *A*, which has to be bored out to the shape indicated. At the bottom of the hole we have had a lot of trouble because the tool formerly used would be somewhat below the center after grinding, or the turret on the machine a little below the center of the spindle, causing a tit at point *a*. This tool is so constructed that the cutter can be raised and kept on the center and turned in any required position. The body of the tool is of the form shown at *B* with a shank to suit the turret. A dove-tail is milled across the face and a slot cut in to a small hole to allow two ¼-inch cap-screws to clamp the forming tool shown at *C*. The tool is turned to shape in a lathe and formed with a conical hub, so that it can be adjusted up and down in the dove-tail slot, turned in any position desired, and then secured by means of the two clamp-screws. ALBERT ELMIGER.



A CHIP GUARD.

A Chip Guard.

Editor American Machinist:

The accompanying sketch shows a chip guard in place on a lathe tool which I have used for several years. Explanation is unnecessary except to state that the wire is spring tempered, in order to fit tightly over the turning tool, and the guard portion is made of celluloid 1-32 inch thick by 2½ inches square.

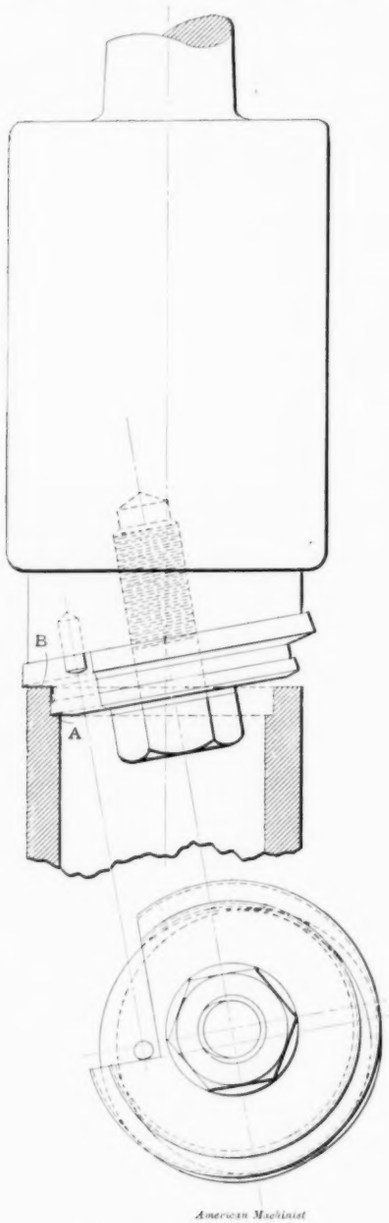
The celluloid could be replaced by mica or wire gauze with equal results.

C. E. J.

Counterboring and Facing in the Drill Press With a Circular Forming Tool.

Editor American Machinist:

I enclose a sketch of a cutter I recently made which, so far as I can find out, is something new, and which has given better results than anything before tried on this work. We had an idle drill press, and as the engine lathes were very busy, I made a jig to hold the work and fastened it solidly to the drill press table. In



THE TOOL AND THE WORK.

the upper part of the jig was put a bushing to fit the cutter arbor and so prevent chatter marks in the work from the jar of the press. The cutter is screwed on the arbor at an angle of 10 degrees and located after regrinding by a pin as shown.

As it is fed down, point *A* starts to cut and continues until the tool is stopped at the desired depth by a stop on the press: as the cutter is made to suit this work, the surface at *B* is finished to just the desired hight.

The piece machined is brass, and we were surprised to find that the cutter finished from 500 to 1,000 of these pieces at one grinding, and that these were all counterbored to within 0.001 inch of the same size. The speed of the cutter is 350 revolutions per minute. R. T. BELL.

Making Flat-End Gages.

Editor American Machinist:

The making of flat-end gages or end measure test gages is generally supposed to be a difficult job, but I have not found it so, though it requires skill and patience. The photograph herewith shows a form of lapping jig that I have found very satisfactory for the purpose. It is made of cast iron and should be not less than 4 inches across the base and 4 inches high. Make at least four castings; face the bottom, cutting out the center ⅛ inch, or more, deep and 2¾ inches diameter, and chamfer the outer corner at the same setting, so that the annular surface will be of equal width all around. Plane out the V-groove perpendicular to the base, with the sides of the "V" about ⅝ inch wide and the included angle 90 degrees. In order to get an accurate job, plane up a piece of cast iron to about ¾ inch square and 5 or 6 inches long, true up *two sides only* to a surface plate, and use this as a surface block for scraping the "V" in the lapping jig. Next make an arbor 6½ inches long and about 11-16 inch diameter —or large enough so that when two of the jigs are placed face to face on the arbor they will not touch each other. This arbor *must be parallel and true.* Place two jigs on the arbor, the base of one to the right, the base of the other to the left, with two grinding lathe dogs or two rings with set-screws in them to hold the jigs and the arbor together, and they will be pretty well balanced. Put them in the grinding lathe on dead centers and true the bases, making them straight across; now they are ready for business, and if directions have been closely followed, the "V" in each jig will be perfectly square with the bottom.

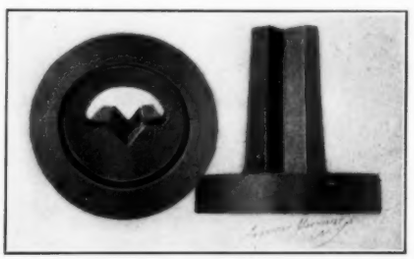
For a lap take a cast-iron plate not less than 10 inches square (larger will be better) and plane one side to as true a surface as the planer will make. It will improve this lap to groove it with a sharp thread tool, making the grooves about 1-16 inch deep and ⅝ inch apart, and running them both ways across the plate. These grooves will hold the lapping material.

Very good gages can be made of drill rod without any machine work. Seven-sixteenth inch drill rod is a good size for gages from 2 to 10 inches long; if over 10 inches use ½-inch stock. Cut off the stock 1-32 inch longer than the gages are to finish. Next put on the size, company's name and toolroom marks. To do a good job of marking with steel stamps a cast-iron block with a planed "V" to lay the gage in while stamping, is just the thing. Do not file a flat place on the gage, as by a little practice a better, neater and quicker job can be done on the round stock. Long gages should be marked in two places—one near each end.

Next file off the burrs and straighten if necessary, and test by rolling on a surface plate. Now we make a guide for filing the ends. Get a piece of cold-rolled steel, 1-16 or ⅛ inch thick, and large enough to make a disk the same size as the bottom of the lapping jig; drill a hole in the center of the disk to let the gage stock through easily.

Put the lapping jig, large end up, in the vise with the gage stock in the jig "V" (a piece of leather being held between vise jaw and gage) and place the disk on top of the jig with the rod projecting through the disk a distance equal to the amount you need to file off. The disk will prevent the file from getting much out of the path you wish it to travel in, will last while quite a number of gages are being filed, and will make as true a job as the lathe.

File the rods to within 0.004 or 0.006



LAPPING JIG FOR FLAT END GAGES.

inch of finish length. It is necessary to allow this for a good finish, as the gages will change some in hardening. To harden, heat them in a lead pot, taking a very short heat, but be sure they are very hard on the ends—the harder the better. Next, polish the gage to as good a finish as you require, *before* proceeding to lap the ends.

Flour of emery and oil make a good lapping material. Spread it around on the lap with a smaller plate to get it even. Use less emery as you get near to the size and finish with turpentine or gasoline. This will give a good finish; so good that when one gage is placed on top of another, end to end—the two being rubbed together till the air is excluded—and the top one lifted carefully, the bottom one will be lifted also. In using the jig hold the gage firmly in the "V" with the hands and at the same time press the gage down on to the plate with a thumb or finger. To get the size accurately the gages must be allowed to cool, though I have often cooled them in water when in a hurry.

True up the bottoms of the lapping jigs frequently by putting them in the grinding lathe, as already described. The plate should be looked after, too.

When the measuring points of the Pratt

& Whitney measuring machine get worn out of true, as they will do, take the spindle out and lap the ends the same as you do the gages. A few minutes' work will bring them back to where they belong.

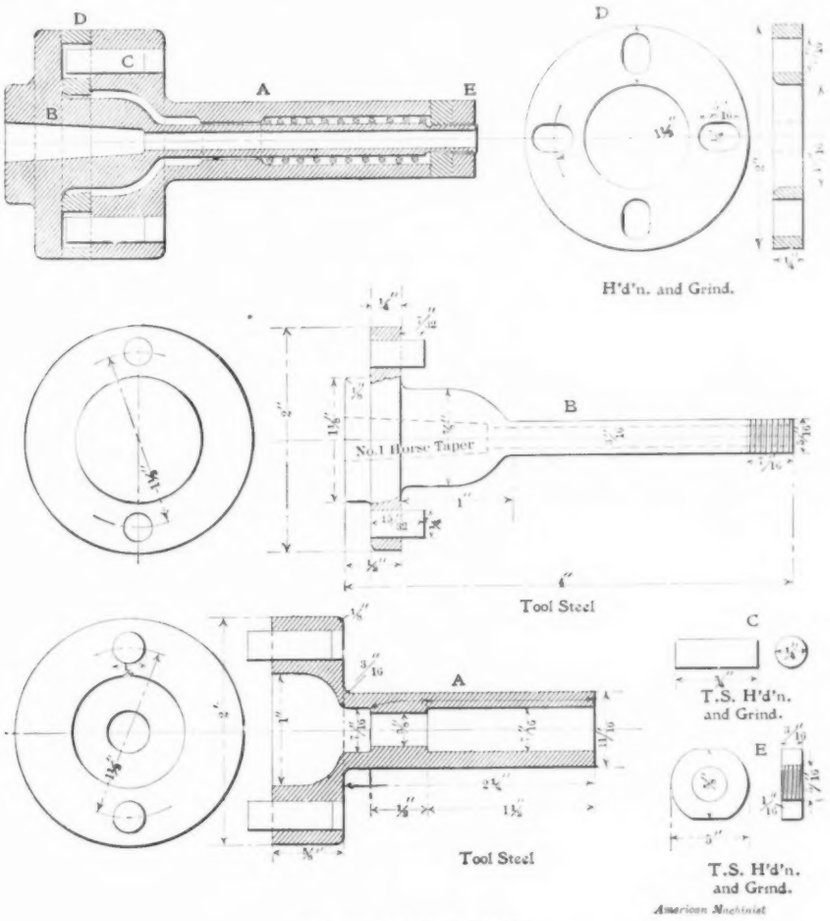
CHAS. W. WRIGHT.

A Floating Reamer Holder.

Editor American Machinist:

This floating reamer holder is made for use in the automatic screw machine. As will be seen from the drawing, *A* is the body provided with a shank to fit the turret holes; it is bored out to receive the floating part *B* and its spring, and drilled for two hardened pins *C*, which are ¼ inch diameter and ¾ inch long. *B* is also drilled for two ¼-inch pins; it is provided with a taper hole for reamer shanks and a 3-16 inch hole is drilled from the bottom of the taper clear through the shank. *D* is a hardened and ground collar in which are four ¼-inch slots, 5-16 inch long, and this collar, when placed as shown between the heads of *A* and *B* connects these two members, and yet allows *B* to travel 1-32 inch from the center in any direction. The spring and the lock nuts *E* keep *B* perfectly square with the turret, yet allow it to slide freely. This holder is neat looking and easily made, and can be left without danger in automatic machines.

NOMAD.



FLOATING REAMER HOLDER.

Shop Systems and Other Matters—An Englishman's View.

Editor American Machinist:

As a student of industrial matters—that is, of systems of wage payment, management, shop systems, etc.—I make a point of reading the many excellent articles that from time to time appear in the columns of the AMERICAN MACHINIST, and I started to read the article at page 30 expecting to find one more from a manager, showing how to drain the last ounce of energy from the American workman, but to my delight I found an article I have long wished to write, and I make haste to thank "A Machinist" for his defense of the honest workman. One thought has always struck me when thinking of most of these systems—that the American working man was either a rogue or a lazy scamp, given to wandering up and down the shop, trying to find what he could purloin for his own use, or else looking for night.

Most of these systems deal with the tools he has to use, when he gets them from the toolroom, when he takes them back, what condition they were in, etc., or with the time he spends on every job. As you remark in your editorial accompanying this article, some system of organization is necessary, but when it comes to such a system as the one outlined by P. E. I., charging a workman for lost bolts, broken tools, etc., I think it time for the workman to protest, or he will soon have to buy all the tools with which he works. Another thing that has struck me is, how do the apprentices learn their trade under these systems, when all tools are ground for them? It would go hard with them if they ever go into a jobbing shop such as Mr. Osborne writes so well about.

You must not think from what I have written that we have no systems here. In many shops the premium system is in vogue, and in a few the toolroom system. The premium system I think will work better than the piece-work system, if the employer adopts it in the proper spirit; but when we find an employer doing as one did lately—allowing seven hours for a job, and one day getting a man to rush one through in five, with the help of the foreman to grind tools, etc., under the pretext that it must catch a certain ship, and when the job comes up again allow only six hours for it, I fear it will fail, for some managers are never satisfied with a fair day's work. If the premium plan is worked in a fair and straightforward manner, I cannot see that any workman could, or would, object to it; but when it is worked as the piece-work system is worked in many shops, where the harder the men work the less they get for the jobs, the case is otherwise.

The engineering industry here is very rapidly becoming Americanized. A large number of automatic turret lathes, twist drill grinders, pulley lathes, mandrel presses, etc., are being adopted; but some firms are only going forward by half-measures. As an instance of this, take the following sample of what I saw pass between a manager and a drill hand a short time since: This firm had put in an American twist drill grinder, and a few days after its erection the manager saw one of the drillers grinding the point of a drill on the corner of the grindstone, as he had been used to doing. The manager wanted to know what he was doing, and on being told that he was thinning the point, he told him that they had bought a machine for doing that, and he must not let him catch him grinding his drills on the grindstone again or he would have to go. The workman explained that it would take him ten times as long to take it to the twist drill grinder as to do the job on the grindstone. "No matter; do as we tell you. Never mind the time—we pay for that," was the reply. When I explain that the grindstone stood at the driller's elbow, while to get to the twist drill grinder involved a walk of over 200 yards and mounting a flight of stairs in addition, you will see that this manager was system mad. In the same shop a Greenerd arbor press was installed. This shop was laid out with the large machine tools at one end and the small ones at the other, the distance betwegn them being at least

150 yards. The arbor press was fixed among the large-sized tools, with the result that when a turner on the small tools wished to change his mandrel he had to walk 150 yards to do so. I could tell you many more cases of half-hearted progress, but the above will do to illustrate what I mean by system mad. FOREMAN.

Nottingham, England.

Two Packing Rings or One?

Editor American Machinist:

The report by Mr. Amos Price of the discussion of the topic "Piston Packing Rings" at page 140, calls to mind the question of "One packing ring versus two rings." This question, of special interest to builders of large horizontal engines, seems to principally involve two considerations: the wearing larger of the cylinder towards the ends, on the one hand, and the excessive abrasion of the cylinder bottom on the other.

The object with the use of two packing rings is evidently to balance the piston by excluding the steam pressure from the portion of the piston between the rings. To what extent such an attempt is successful, depends largely on the condition of the cylinder bore, on the packing rings

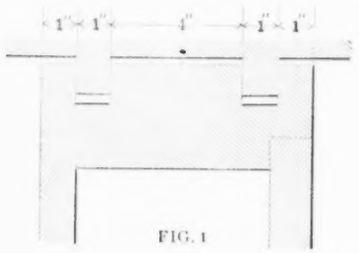


FIG. 1

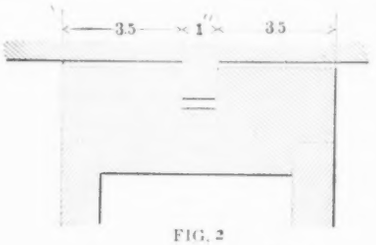


FIG. 2

American Machinist

TWO PACKING RINGS OR ONE?

themselves and on their fit in the piston. My opinion is that with new cylinders, finished as they generally are in practice, the steam inclosed between the rings will generally have a pressure fully equal to the mean between the admission and exhaust pressures. This opinion is founded upon an investigation which I once had the opportunity to make. By drilling a hole in the top of a 24-inch horizontal piston, between the rings, into the hollow of the same, and from there carrying a pipe through a stuffing-box in the back cylinder head, it was possible to gage the pressure which existed in the space between the rings. The pressure varied between 20 and 50 pounds when the initial pressure in the cylinder was about 90 pounds. This case is no conclusive evidence, however, that the pressure between the rings will always be in the same rate for any cylinder, but it goes to show that, even with a cylinder that has been smoothed down by wear, and where the packing rings have worn to better bearings than a new piston affords, a considerable pressure exists at this place.

Estimating the pressure with which the piston bears on the bottom of the cylinder, in the case of a double ring piston and in the case of a single ring piston, in order to compare the results we assume that the pressure between the rings is one-half the difference between initial and exhaust pressure. Let us assume a case in which the diameter of the piston is 30 inches, the initial steam pressure 100 pounds gage, the exhaust pressure 0 and the dimensions of pistons and packing rings to be as shown in Figs. 1 and 2. Then we get as follows:

Pressure on the projected surface the full length of the piston and one inch wide:

For double ring piston—

1 sq. in. at 100 lbs. per sq. in....	100 lbs.
4 sq. in. at 50 lbs. per sq. in....	200 "
Total.....	300 lbs.

For single ring piston—

3½ sq. in. at 100 lbs. per sq. in..	350 lbs.

The pressure per square inch due to the steam pressure alone is therefore in the case of a double ring piston 50 pounds, and in the case of a single ring piston also 50 pounds. Add to this the load due to the weight of the piston (about 1,200 pounds) resting on a projected surface of 180 and 210 square inches, respectively, for double ring and for single ring piston. This is, respectively, 6.7 and 5.7 pounds per square inch. We get, then, for a double ring piston a total pressure of 56.7 pounds per square inch and for a single ring piston a pressure of 55.7 pounds per square inch. These pressures are practically the same.

Now, if we look into the way these pressures act during the stroke of the piston, we find that in the case of a double ring piston a pressure of about 40 pounds is acting during the whole stroke and 17 pounds during the period of admission, diminishing gradually as the expansion in the cylinder takes place, until near the end of the stroke it becomes less. In the case of a single ring piston, on the other hand, the full pressure of 50 pounds acts during the period of admission, and this pressure gradually decreases until it at the end of the stroke becomes zero, and only about 6 pounds per square inch, or the dead load, due to the weight of the piston, acts throughout the entire length of the stroke.

Why a relatively light pressure of 60 pounds, or less, per square inch on the piston causes often great damage in the steam cylinder, particularly in new low-pressure cylinders of large size, is explained in many different ways. Sometimes it is claimed to be due to grit carried over from the boilers, sometimes to core sand from insufficiently cleaned steam ports or cylinder castings; sometimes the blame is laid on too soft cylinder iron or too inefficient lubrication, etc. Whatever the actual cause may be, it is probably most directly due to poor lubrication.

The lubrication of the piston is undoubtedly much more effective when there is only one packing ring; in which case, during a certain period of the stroke, the pressure is not far from being entirely relieved from the piston, thus affording the lubricant an opportunity to work itself between the abrading surfaces. In the case of two rings there is a far greater constant pressure on the piston during the entire stroke, and, besides, the rings afford a quite effective means of catching between them and holding whatever abraded material there may be, which tends to make things worse.

Babbitted bullrings and wearing shoes for heavy pistons have, for similar reasons, not proven very successful. If abrasion sets in, then the abraded material is apt to catch to the babbitt and thereby effectively annihilate whatever antifrictional properties this metal may possess. The packing rings themselves (in the case of a double-ring piston, the one nearest the pressure side) are, of course, at all times set out with a pressure practically equal to that on the pressure side of the piston, plus whatever they may be loaded with by springs. As this pressure is a good deal more than what comes on the bullring, and as still, in a bad case, the rings themselves do not show the same wear as the bullring or the cylinder, it goes to show that the rings must be far better off in the way of lubrication than the bullring or wearing shoe. So they are, and the reason for this is identical with what in the above has been claimed as an advantageous feature of the single-ring piston as a whole, namely, that at the end of each stroke the ring is relieved of the steam pressure and becomes quite free, and the lubricant has then a chance to flow underneath it.

In smaller cylinders, say up to 30 inches, there is seldom any trouble from excessive wear of the cylinder bottom, and therefore in regard to these it may be well to seek to equalize the legitimate wear throughout the length of the cylinder by using two packing rings; but where there is a serious risk of the piston cutting, one ring is much to be preferred.

GESTRIC LAND.

A Floating Reamer Holder.

Editor American Machinist:

The accompanying sketch illustrates a floating reamer holder, which, if properly constructed, will really float. It consists of the shank *a*, Fig. 1, fitting the drill

chuck or socket and driving the piece *b* turned to fit the hole in *a* and pinned to it at *c*. Piece *b* is connected to the shank *d* by two universal joints *e f*. Tool-steel plates *g h* are hardened and ground parallel on the faces and to fit the counterbores in *a* and *i*, and have between them the balls and ball retainer *j*. The socket *i* is bored to take the reamer or tool shank, which in this case was keyed and held by a set-screw, as shown. The shank *d* is turned with clearance for the bore of *a*, and the reamer is thus able to float quite freely to the limit of the clearance. Of course, the hole for pin *c* should be relieved slightly to prevent the pin from drawing the parts too closely together and thus create so much pressure on the balls that they would not roll freely. Fig. 2 shows a section of the universal joints on lines *x x*. FLOATER.

Shop Systems

Editor American Machinist:

One of the most common methods of attacking a principle is to seek an instance where special circumstances make its application, without modifications, difficult or unwise; or, where a mistake in some of its details partly or altogether neutralizes the value of the whole.

This appears to be the line of argument adopted by "A Machinist" in his sweeping condemnation of "P. E. I.'s Tool-Room System" at page 30. While I would be the last to deny that many a good system has been ruined by over-elaboration, I do not think that the defects he sees, or thinks he sees, are attributable to the principles underlying P. E. I.'s or any other proper shop system. More than that, the system itself is fairly entitled to the credit of bringing to light some of the abuses for the existence of which it is so unfairly blamed.

"A Machinist" claims that many modern systems use up more than the saving they effect in the cost of keeping them going. Possibly they do, but whether or no, no one except those in actual control of the entire organization can judge. The cost of operating any special system is a tangible dollar and cent matter. On-lookers, whether in the office or the shops, can usually form a pretty close estimate of its amount, but the savings effected by systems cannot be even approximately guessed at by any but those intimately and constantly connected with its workings year in and year out. If a machinist designs a set of special tools to manufacture a certain article, he would hardly think the cost clerk competent to say he was using up more time than he would save in the manufacture; that his tools were costing more than the saving they effected, or would ultimately effect. One of the most important functions of a cost system is to secure information and to make records, and if certain methods devised with these ends in view appear cumbersome and unwieldy, it may possibly be because the machinist knows no more about their real object and value than the cost clerk knows of the practical worth of the special tools or of the complicated dies made up to do special mechanical work.

The principle that all shop tools should always be in good order and condition for the workmen next requiring them is a good one, "A Machinist" admits. Possibly in P. E. I.'s case this end was not being secured, but the fact remains that the principle is good, while its application was not wholly satisfactory, which, in this particular case, may be owing to special circumstances or to injudicious methods. Any shop system, however, which demonstrates that a workman has to wait at the tool-room window three times as long as it would take to grind a chisel has pointed out one channel of waste, and to that degree justified its usefulness.

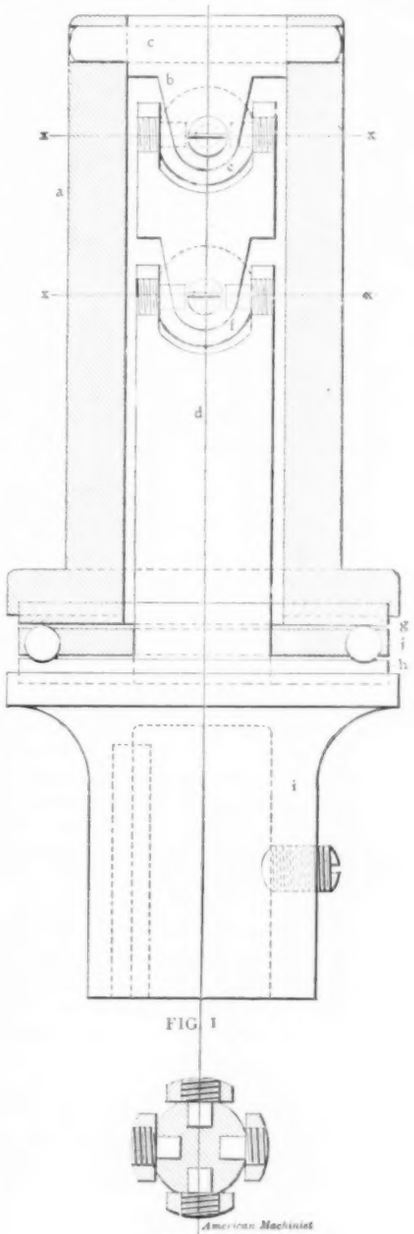


FIG. 1

FIG. 2

A FLOATING REAMER HOLDER.

"A Machinist" makes a very common mistake when he speaks of a firm that cannot trust its employees with a bolt. In shops where bolts or other small articles are not issued without a written charge being made the object is to secure correct records of costs, either of the article being manufactured or of the work being done on which that bolt is used. Under no circumstances that I have ever met with were such small articles made the subject of written record as a means of preventing workmen misappropriating them or in any way because the firm could not trust its employees. If workmen would realize this, very much of their dislike of requisitions and charge slips would be overcome; and it must be remembered that in a business of even moderate size the records kept concerning any given article can never under any circumstances represent in their aggregate one bolt, or two bolts, or a dozen bolts, but, spread over a considerable number of years, may amount to a considerable sum. In many cases it is undoubtedly wiser to charge out certain small articles in bulk and then have them free to those who may require them, but this again is a question of a detail of applying a principle and not of a principle itself.

"A Machinist" has the very usual fling at "dead heads" and non-producers. In most of the best shops to-day some who come under that head are turning out product each day beside which the material output of the shops is of comparatively little value. If a cost system obtains information by which it is shown that under existing methods of manufacture individual articles, the output of certain shops, or the entire product is being sold at or below cost; if, in the light of this information, other methods are devised which result in lessened costs, who is primarily responsible for the profit resulting? Certainly not the workman, and as certainly not a management which would have been satisfied with the old methods had their danger not been pointed out. Who brings each day the great steamers safe into New York harbor? The captain, and the crew who do the work, or the pilot who "does nothing" but simply shows the channel to safety and points out where the dangers lie? Yet, the pilot is both a dead head and a non-producer. COST CLERK.

Editor American Machinist:

It is some time since I have read an article with such interest and pleasure as the one at page 30 on shop systems, by "A Machinist," and the editorial commenting on the same. It is indeed true that employers could often and in many ways be fairer and more generous to their workmen. I am always an interested reader of articles on shop management and understand that shops are run for the purpose of making money, and that journals like the AMERICAN MACHINIST are printed and subscribed for in order that

the best and quickest methods of production may be attained.

But is it not true that in most articles on this important subject there is very little, often no, thought given to the men who build the machines which are the admiration of the world? The writers of such articles, brimfull of business, seem to forget all about the comfort of the machinist whose life is constantly becoming more strenuous in this day of four-headed planers, high-speed steel and lathes which keep him on the jump trying to caliper a bar of steel running like greased lightning and dodging red-hot chips at the same time. As I am one of these rather neglected appendages of a machine, I would like to offer a few suggestions on shop management, which, for the small outlay of money and time needed to put them in operation, will, I venture to say, pay bigger dividends than any other like sum invested in the business.

One of the most frequent causes of complaint among the men is the neglected condition of water-closets, lockers and wash troughs. In some of the shops occupying old buildings the condition of the above named conveniences is something awful, and I have often wondered how self-respecting machinists could work in such places, especially in the vicinity of the first named convenience. Many of these shops have no lockers, the men being obliged to hang their clothes on the walls, to become oil spotted and dirty, thereby making white collars and neat dressing an impossibility.

I am pleased to see, however, that these relics of a bygone age are fast disappearing and neat, modern shops are taking their place, in which the comfort of the men is taken into consideration. In most of them there are one or more rooms used solely for lockers and wash troughs, but I have seen many shops, although installed with the most sanitary plumbing fixtures and drainage, become the reverse of sanitary in time through neglect. It is a true saying, "What's everybody's business is nobody's business," and this holds true when everybody is depended on to keep these fixtures clean. This cannot be said of the larger shops, where hundreds of men are employed, because these conveniences are so extensive that one or more men are employed for this purpose alone. Smaller shops might follow this example with profit. There are plenty of old men who are capable and willing to do this work for a small wage, and their spare time, apart from this work, could be devoted to cleaning the office, washing windows and similar work. The dividends which this small investment would yield would be the appreciation of the men and the satisfaction of seeing them work in surroundings that would create a spirit of tidiness in them.

Then there is an almost indispensable article to a machine shop that is more often absent than present, and that is, a medicine chest. What place is more conducive than a machine shop to cuts, scalds, burns and more serious injuries?

In these days of rush and hurry, when the workmen measure, caliper, change tools and do other work while the machine is running, accidents are well-nigh unavoidable; yet how inadequate are the means to relieve the pain or bandage the wound! Usually when a workman gets a cut or a mashed finger he must be satisfied to tear a piece from an old rag or handkerchief, unless, fortunately, he or some fellow workman happens to have a clean bandage or some court-plaster in his tool chest. In the case of a more serious accident the workman must remain uncared for till the arrival of a physician. How often could the intense pain in an eye, due to a hot chip, be relieved by having one of the many soothing eye-waters handy!

These medicine chests are very cheap, and every shop can afford one, or at least make an improvised one and stock it with the most necessary articles, such as clean linen bandages, scissors, absorbent cotton, court-plaster, eye-water, salve, vaseline, a book or pamphlet on "First Aid to the Injured" and other inexpensive but useful things that will alleviate the pain and annoyances these accidents cause.

A step in the right direction that is being taken in many shops relates to the education of the men and boys employed. The value of an education is becoming more and more evident to the men, and employers are waking up to the fact that *it pays* to employ men who keep abreast of the times by reading trade journals and the latest mechanical books, and it is a pleasing sign of the times to learn of employers who install reading-rooms and libraries of mechanical works, to which the men have free access.

It is almost impossible for the average machinist, especially handy-men and apprentices, to acquire a good library of these books, owing to the wide field they cover and the consequent cost, these books costing more than others, on the average. I was recently employed in a shop that had an excellent library, to which the men had free access, and they took full advantage of this opportunity and were fully appreciative. Many of the men bought books who would not have done so had they not had the opportunity to see them and recognize their value.

In conclusion, I would like to say a few words regarding apprentices, the machinists of to-morrow, who play such an important part in the modern shop. If there is anything outside of the legitimate business of a shop that the employer should be interested in, and deeply, it is the boys whose future welfare and usefulness are in his charge. It pains me sometimes when I see these boys coming into the shop to play their part in the rush of modern shop life and given in charge of a gang foreman who has no further interest in them than to see that their time cards are up to expectations, the employer taking little or no interest in them. These boys, in the ignorance and carelessness of youth, incapable of realizing the future value of an education in mathematics and drawing, are put to work running a drill press, turret lathe or doing such work as is usually allotted to boys without thought as to their various capabilities, and left there till their wages increase gradually to the point where it is unprofitable to keep them at that class of work, their advancement being governed mostly by accident or chance, as an opening occurs. Sometimes a boy is put on a planer, a lathe or a grinder, when he might have made a good draftsman or toolmaker, and sometimes a good shaper hand is spoiled by trying to make a toolmaker out of him.

"But," the employer will say, "you cannot keep a good boy down; if it's in him, it's bound to show up."

That is undoubtedly true in some cases. If a boy has exceptional talent for some certain thing, is far-sighted beyond his years and has the spirit of determination that surmounts all obstacles, he will succeed, as he deserves. But of how many boys is this true? Ask the average toolmaker getting a fine salary how he came to follow that most desirable branch of the trade, and he will most likely say: "Oh, I started in the business handing out tools, and one day the fellow on the milling machine quit or got fired and I got his job; then they taught me to temper tools and such things, and here I am," and he will smile complacently while he laps a gage within 1-10000 inch error limit.

Then go out of the toolroom into the shop and ask a man who never got beyond running a radial drill, why he never advanced beyond that stage, and he will very likely say: "Well, you see, when I started in the business they put me on a drill press, then on a radial, and I knocked out the work in such good time that I've been doing this ever since." "Can you temper a tool, or could you make one of those gages you are using?" "No; never had a show at that kind of work." "Never had a show!" What a common excuse, yet how true it often is! "But," the employer will say again, "we cannot make a toolmaker out of everybody." That also is true; but could you not, Mr. Employer, adopt a plan, in fairness to the boys, whereby these most desirable positions could be apportioned on a fairer and more equitable basis, not according to chance but merit?

Most boys, even if they have ability and talent, do not see the value of an education, and unless there is a incentive to stimulate them they neglect this important matter, to their regret in later years. My idea is to have a competitive examination once or twice a year, in mechanical drawing and mathematics, and have them answer various questions on shop matters to test their inventive ability and powers of observation. Inform the boys, when hiring

them, about this, telling them what to study, and increased zest and endeavor would be put forth if some prizes were offered, as a tool chest, micrometers, drawing instruments, etc., giving something to each boy who earnestly tries to secure a prize.

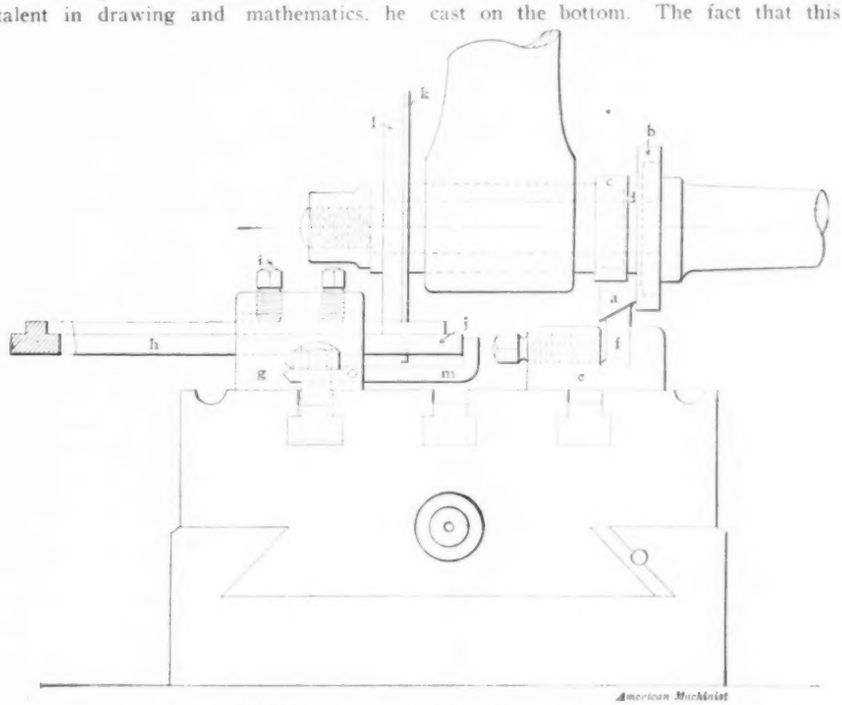
Then the employer could see what was in each boy. If one showed exceptional talent in drawing and mathematics, he would be the one to put in the drawing room; while if one should show ability in designing and seeing the why and how of things, he should have the chance in the toolroom. Finally, if a boy who, with all this incentive and opportunity for self-improvement and study, were one day asked, while chipping castings or hauling turnings, why he never got beyond that, he would certainly speak untruly if he said: "Never had a show."

I am glad to say there are many shops now carrying out these ideas; they are successful wherever tried, but such shops are still in the minority. We hear a great deal nowadays about the identity of interest between employer and employee, and are told that if either would succeed and prosper they must work together in harmony. The employer would have less to fear from the walking delegate if he would more often devote his thought to the comfort and well-being of his men. It is amazing how much esteem and gratitude can be won from them by a little outlay of money and time. "Esteem and gratitude! They do not increase the assets of a firm!" But they do. When the employer looks through the shop, and sees the men and boys working with all their power of brain and muscle amid conditions that incite them to do their best, he must feel, if he is any kind of a business man, *that it pays*. A. TURNER.

Doing Two Different Jobs on the Milling Machine at the Same Time.

Editor American Machinist:

I had to mill a good many gibs like that shown at *a* in the sketch, using the gang of mills *b*, *c* and *d*. These gibs were cast iron, ¾ inch thick, ranged in length from 10 to 15 inches, and were held in the jig *e* by means of two lugs *f* cast on the bottom. The fact that this



MILLING TWO JOBS SIMULTANEOUSLY.

job consumed no small amount of time worried me considerably. A day came, however, when I had about seventy-five of these gibs to do, besides about one thousand and one other jobs—and all in a hurry, too.

While setting up the machine for the gibs the fact struck me that I had room on the cutter arbor for another set of cutters and, also, room on the table for another job. So I started a cut across the first gib, looked for another job to put on the machine and selected the one shown to the left in the sketch. The fixture *g* is about 12 inches long, and the pieces *h*, which are planed to the shape shown and in lengths of about 4 feet, are placed in the jig—a number at a time—and held down by means of set-screws *i*. These pieces have to be cut off and milled at *j* by means of the saw *k* and mill *l*, the gage *m* being used to keep all the pieces to the same length. JOHN A. CAMM.

Cutting Left-Hand Threads.

Editor American Machinist:

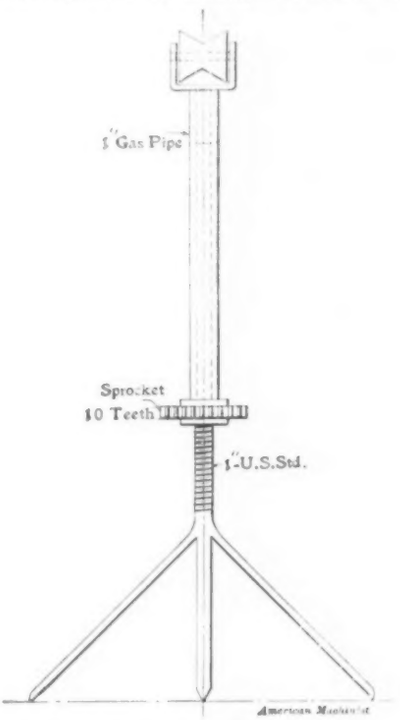
Some years ago I had to make a good many hydrant spindles with square left-hand threads cut close up to a collar. The first few took a long time to cut, as it was very difficult to "catch" the thread just clear of the collar even with the lathe running very slow. The difficulty was, however, overcome by running the lathe backwards and inverting the cutting tool. This change gave a cut from right to left as in the usual manner of screw cutting, enabling the tool to cut close against the collar to a drilled hole, and making a nice finish in quick time. The nuts were cut in the same way. C. R. WALKER.

Trinidad.

A Handy Support for Shafting When Splining in the Miller.

Editor American Machinist:

The sketch shows a handy support for use with the bolt cutter or when keyseating shafts in a milling machine. In the latter case some trouble is usually experienced in keeping the shaft level with the table so as to avoid cramping it and causing it to bind, and this support entirely does away with this difficulty. The stand is made of a cluster of four ⅝-inch rods welded to a 1-inch round stem, the feet being sharpened to stick into the floor; the stem is threaded 8 per inch its entire length in a bolt cutter, and also splined. The sleeve is made of 1-inch iron pipe, one end being threaded and screwed into the upper yoke which is made of ½x2-inch flat iron; a pin driven into the sleeve acts as a key to prevent it from turning. The roller is



ADJUSTABLE SUPPORT.

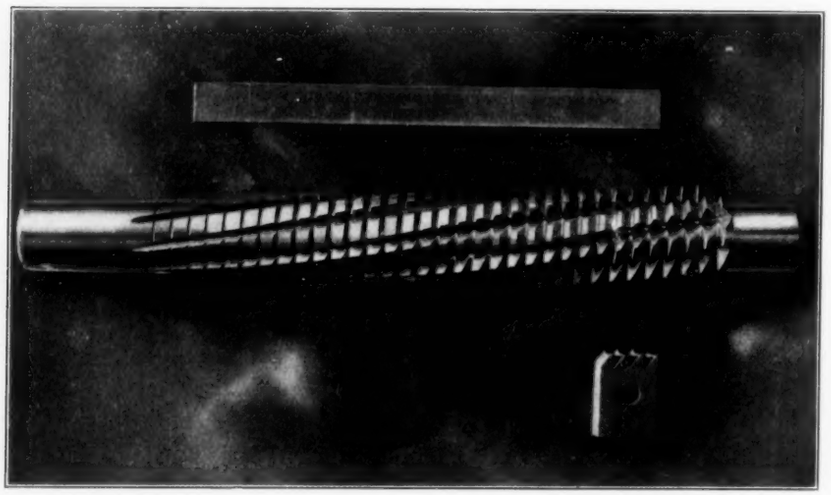
made of wood. A 10-tooth sprocket for No. 24 link belt is tapped and faced for the stem and can be used for a hand-wheel, or in most cases connected to the elevating handle of the milling machine with a chain belt at a quarter-twist; an 8-tooth sprocket on the handle is correct for most machines. With this device a shaft can be raised or lowered without any danger of cramping or injuring the machine. GEO. J. MEYER.

A Peculiar Job of Hobbing.

Editor American Machinist:

Some years ago I took charge of a shop connected with a large factory—one of the oldest in the country—where builders' hardware was manufactured.

The shop was equipped with an odd assortment of tools, which from appearances had been bought second-hand many years before. They were in a condition somewhat discouraging, to say the least. The factory itself had in daily operation from 1,000 to 1,500 automatic machines of various kinds, and it was the business of the shop to keep these in repair and supplied with tools. The intention was to keep on hand a stock of extra tools and spare parts for machines, in order to avoid delay in case of breakage. The methods at this time were such, however, that this was not always done, and as a result there was much delay and a corresponding loss of production. I endeavored while there to correct these conditions, and by the use of special tools and some new machinery, together with systematic management and plenty of hard work, met with some degree of success.



THE HOB AND THE WORK.

Below is given a description of some tools adopted for one job, which have some unusual features and which may be interesting to AMERICAN MACHINIST readers. It might be well to give first a description of the work and the methods previously used in producing it. The photograph shows the work, which is a follower similar to those used for chasing threads on a Fox lathe, but in this instance used on automatic machines for the manufacture of wood screws. The chasers were made of tool steel, of a section ¾x1½ inches and about 2½ inches long. The stock was planed up in bars about 2 feet long with a tongue on one side to fit the holders, and the blanks were then sawed to length on power hack-saws before cutting. The holes were also drilled for bolting them in place on the machines.

The pitches of the thread varied from 10 per inch in the finest to 2⅓ in the coarsest. In use they were geared down 3 to 1, so that the 10-per-inch cut a 30-per-inch thread. The method employed for many years in cutting was as follows: They were bolted one at a time in a fixture on an ordinary 16-inch lathe, the screw of which was geared to the pitch desired. With a boring bar rotating on centers and carrying an inserted cutter they were bored to a circle having a radius of about 1½ inches. The tool was then removed and a threading tool inserted and the teeth cut by a large number of passes by the revolving cutter. After each pass the cross-slide was withdrawn to clear the cutter and the carriage returned by means of the reverse belt, the leads in most instances being fractional. The threads were all left-handed and, as shown, of a ratchet form, having a depth about equal to the pitch, and a slight flat at top and bottom. As may be imagined, this was a slow operation, the cutting of one of the coarser pitches taking two hours or more. One man was employed on these tools continually, and even at that machines were frequently stopped waiting for them.

To handle this work expeditiously, a number of hobs were made, one for each pitch, which solved the problem in a most satisfactory manner. The photograph shows the largest of these with a 12-inch scale above, which gives a good idea of the size. This one had a total length of 19 inches and the smallest 12 inches, all being 2⅝ inches on the largest diameter.

The blanks were turned from Jessop steel and tapered from the bottom of the thread on the small end to within a short distance of the large end, so that when cut two threads were left complete. Great care was used in cutting the threads to have them as smooth as possible. The fluting was done with a spiral cutter at an angle of about 15 degrees with the axis, the cutting side of the tooth being a radial line. Eight flutes were cut, leaving a land from ⅜ to ½ inch in width. The tops of the threads were then backed off by hand to give a clearance of 8 or 10 degrees.

Trouble was expected in hardening, especially with the larger hobs, but they went through this operation with practically no distortion. They were packed in a case with charcoal and heated slowly in a charcoal fire, the large size taking four or five hours. They were then dipped in brine enough to harden the teeth, when they were transferred to oil until cold. This left the teeth hard with the center comparatively soft, and it was found unnecessary to draw the temper at all.

In use, the hobs were driven on the centers of a stiff 18-inch lathe by a dog on the small end, the lathe being geared to the same lead. The follower blank was held in a fixture on the cross-slide, on a line with the centers. It was secured by a bolt through the center, the tongue fitting the fixture so that the piece was perfectly rigid. The blank was then fed into the small end of the hob by the cross-feed screw until milled out to an arc of a circle. When this was done, which was in a very short time, the lead-screw nut was locked and the blank carried the whole length of the hob, being milled complete in one pass.

The quality of the work was far above that produced by the old method, while the cost was a very small fraction of what it was formerly. The largest sizes were completed in from five to eight minutes each, the hobs being run quite slowly.

The taper was designed to give each tooth a cut of about .002 inch, and after considerable use these tools showed no signs of wear. C. E. S.

Holding Slender Work on the Planer.

Editor American Machinist:

I recently had a pair of ½-inch pieces that were very slender and it was next to impossible to hold them while planing the joint. I made a wooden frame to lay around the pieces, laid them both on a planed plate, with the straight side down and poured babbitt in the frame to the thickness of about an inch. I next put the babbitt with the piece cast in it on the planer, planed a couple of strips for parallels and, turning the piece over, planed the required amount from both piece and babbitt, when all I had to do was to cut the babbitt from the pattern, and I had a good square job. GEO. J. HALEY, JR.

Holding Steady Rest Work on the Live Center.

Editor American Machinist:

Where there is no regular clamp or device for holding light work on the live center of the lathe while the opposite end is held in the steady rest many lathe hands resort to the use of belt lacing or cords with which the work with the lathe dog attached is tied to the face-plate. Insulated copper wire such as is used by electricians for wiring buildings will be preferable to the above, as it is not apt to break and allow the work to slip from the

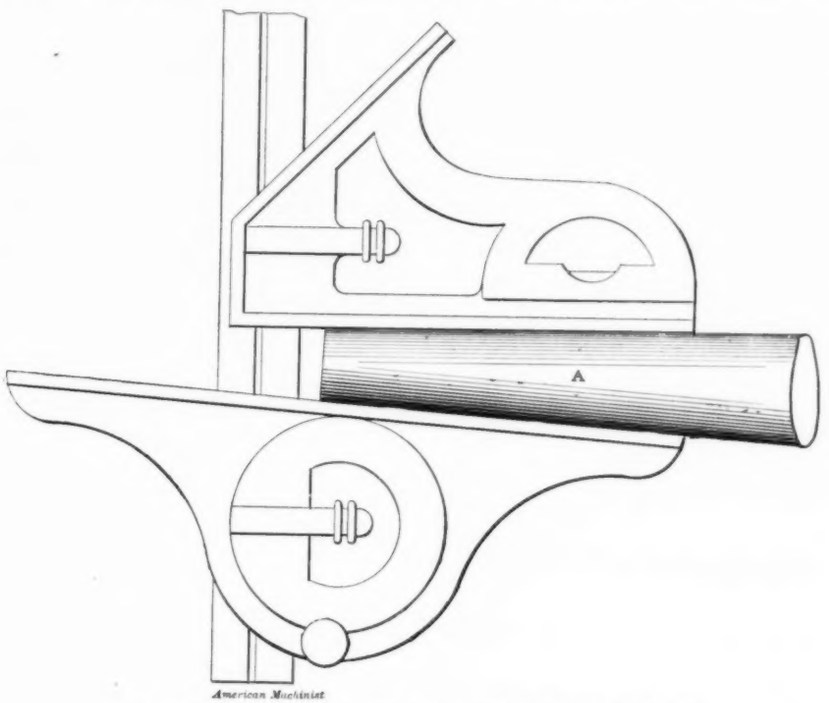
center. It can also be twisted and tied in knots a great number of times without being injured. C. S.

The Combination Square and Protractor as a Taper Gage.

Editor American Machinist:

At different times there have appeared in the columns of the AMERICAN MACHINIST sketches and descriptions of devices for gaging taper work such as lathe centers, taper reamers, etc., and no doubt they have proved themselves valuable tools wherever used; but in many instances their construction was more or less elaborate, making their cost prohibitive where there was not enough use for taper gages to warrant any great outlay in their making.

I was strongly tempted to make one for my own "kit," when the thought occurred to me that perhaps I already had something that would just as well answer the purpose, and the result of my investigation is represented by the accompanying sketch which, as will be seen, shows the bevel protractor, blade and 90-degree head of a combination square outfit which is found in almost every machinist's "kit." The piece *A* is any piece whose end is turned



COMBINATION SQUARE AND PROTRACTOR AS A TAPER GAGE.

taper, as shown. This combination makes a very rigid outfit for the work and needs only to be tried to be appreciated.

E. A. R.

A Remodeled Rachet Drill.

Editor American Machinist:

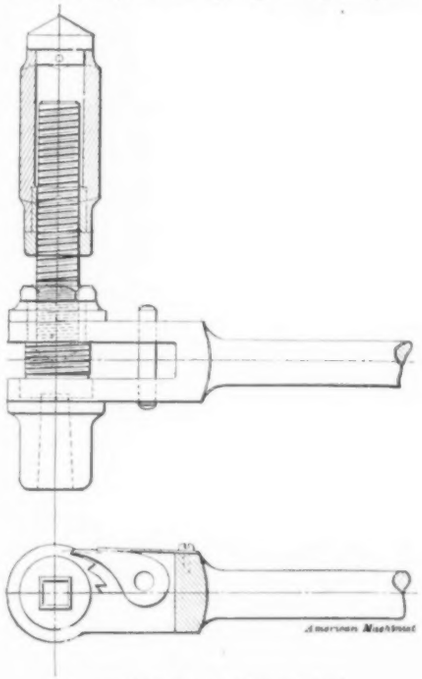
In looking over the stock of ratchet drills in any large hardware or machinery supply store, one finds a great variety, few of which in service will be found satisfactory as to wear and maintenance. Their general design and finish are all that could be desired, but appearances deceive, for finish amounts to little when durability in the wearing parts is the thing most wanted. With the exception of the "Renshaw," as manufactured by the Pratt & Whitney Company, and a few other makes, they are made of soft steel or iron, and are not hardened. Another abominable feature is the inserted key used to hold the gear fast to the barrel.

Having used and repaired nearly if not all the various makes, I herewith describe a durable repair to one variety, which nearly amounted to a complete replacement, in that the handle and feed nut shell alone were retained, and these altered as shown.

The ratchet was a small one with a box feed nut. The handle and barrel were soft, and the gear, which was the only part hardened, was fastened on the barrel with a ¼-inch key. In service it lasted for a short while, and when worn it was worn out all over.

We re-reamed both bearings in the handle jaw, bored out the feed nut shell and bushed it with a hard brass nut. The new gear was threaded to screw on the barrel to a shoulder. Both barrel and handle being made of soft steel, we case-hardened them, lapped the holes in the jaw, and ground the barrel to a nice running fit. The gear and pawl were made of tool steel hardened in oil. The end of the feed screw, which was also made of tool steel, was threaded to suit a ⅞-inch, 12-thread hole tapped in the end of the barrel, and the jam-nut set down hard on the latter, the nut retaining the loose collar which aids in keeping the barrel in line.

With these improvements this ratchet is in shape to outlast a dozen of the old kind. The repairs would be: a new feed nut and a pawl or spring and perhaps a



A REMODELED RATCHET DRILL.

pawl pin, but the barrel, handle and gear should last for years.

On rough shop and road use, in places where a more elaborate tool would be an extravagance, this little fellow fills the bill. H. E. B.

Skill in Grinding.

Editor American Machinist:

In my long reading of the AMERICAN MACHINIST I have found few things more interesting than the recent articles by Mr. C. H. Norton which have told us so much about grinding operations. They appeal to me in several different ways. The details of the actual operation of grinding as now practiced are interesting to me as the later revelations of an art which has traveled far, but with marvelous rapidity, in its development. Probably few realize how recent is the advent of the emery wheel as an article of manufacture and merchandise and how still more recent has been the placing of the grinding machine in the list of standard machine tools. In my early days in the shop, about the middle fifties, I was once set to grind a piston rod about 1¾ inches in diameter on the lathe centers, running back and forth under it a block of grindstone, say, 8 inches long, with a semicircular groove in it approximately fitting the circle of the rod. The stone was raised to press against the rod by tilting the rest, for which there was a screw at the back, and a stream of water was kept constantly running on the work. I don't believe anybody had any very clear idea as to the purpose of the grinding, whether it was to make the rod rounder

or smoother, or of a more uniform size throughout its length. I think I ran the lathe on that grinding job all day, and I do not know that the rod was appreciably improved. Every time I examined the block I found a considerable portion of the grinding surface glazed, and this glazing I would have to dig or scrape off and start again. I fed in grindstone dust to help to enliven the cutting, but, taken all in all, the operation was not a success. The thing that I remember most vividly is that I had such difficulty in getting the stone to cut, and I can hardly say that it did cut at all; it only seemed to wear the iron away a little. If I had known what a shop micrometer was and how to use it, I could have worked to most minute accuracy, because the cutting was so slow. The grinder of to-day cuts sure enough, and the care of the operator is now largely directed to the regulating and often to the restraining of the cutting.

In the early days of the Civil War we struck a line of work which involved a lot of grinding, not for sizing or accurately shaping, but for finishing irregular surfaces so that they would both handle and look satisfactory. The work was in fact the making of bits for cavalry and artillery horses for the army. In the line of grinding we were materially helped and instructed by men who had been employed in an auger factory not far away and whose business dropped dead when the war broke out. Axes and hoes also had been made in the defunct factory and the men presumably knew the most effective grinding practice of that day. The wheels we used then were of light wood with leather pegged on to the edges and the emery glued on to the leather. One man was kept busy in fixing up the wheels as they wore out, having a lot of duplicates ready every morning. Then we used also emery belts about ¾ inch wide running over flanged or grooved pulleys, say, 18 inches in diameter and 6 feet apart. Quite an astonishing lot of grinding was done with these facilities (?), but it did not take me many minutes to realize the cutting ability and the staying qualities of the new emery wheel when I first saw it. The "Tanite" was the one I first knew, but several others came along very soon after. Of course no one realized at first what the wheels were destined to do, but their work has been as revolutionary as it has been rapid in upsetting "time honored" practice.

If an old-time machinist should undertake to be a modern grinder, doing such work and with such minute accuracy and such rapidity as Mr. Norton tells about, he would at once realize the immense change in his working conditions. Take the cutting tool itself. In any machine work, whether on lathe or planer, or shaper, or what-not, the shaping and tempering and grinding of the tools have been the most important and responsible of the operations of the shop. Here has been required to be concentrated the most knowledge and judgment and the most patient and persistent care attainable. With the advent of the grinder a large part of those old skill requirements is absolutely eliminated. The skill of the tool dresser has died a sudden and violent death so far as the work of the modern machine grinder is concerned. Of course this skill has been replaced by the skill which prepares the emery wheels; which skill I can fully concede must be not less than that of the individual tool dresser, but by the new and highly economical arrangement the tool dresser for the individual shop and the tool grinder and setter for the single machine in the shop are replaced by the one emery wheel establishment which furnishes the tools precisely and reliably adjusted for, we may say, thousands of shops and tens of thousands of machines. If the last numbers are too high just now, we will not be long in reaching them.

There is not less skill required than of old for the doing of the final, precise and responsible operations of the shop, but vastly more, so that as the requirements for finish and accuracy have become more exacting it would be impossible for any grinder doing the jobs of quick and perfect grinding described by Mr. Norton to make any such turnout of good work if he had also to prepare and adjust his cutting tools as of old.

There is nothing better that Mr. Norton has done in his writing about the operating of the grinder than his insistence upon the "loyal, intelligent American workman" as a most necessary part of the outfit. The new systems of shop management, so called, are suggesting that shops can be run and good work can be turned out and lots of it by men who know very little, and that the work can be supervised and directed by other men who each know only one detail of the operations involved. The new system of shop management should be at its best in directing the new operations. I would like to see an average man set to do a perfectly possible but exacting job of grinding directed by a speed boss, a feed boss, a time boss, a dimension boss, and any other bosses whom the system involves. It would not be long before the deportment boss would have his hands full.

TECUMSEH SWIFT.

A Special Chuck for Threaded Work.

Editor American Machinist:

Having seen several special chucks in the AMERICAN MACHINIST, I thought I would contribute my mite by sending a drawing of one we used in finishing some forgings of steel on a screw machine. The only one available was without wire feed. It was necessary to design the chuck so that it would hold the forgings by the threaded hole, one side being faced when tapped; it was also essential that the design should be such that the work could be easily removed and without being defaced.

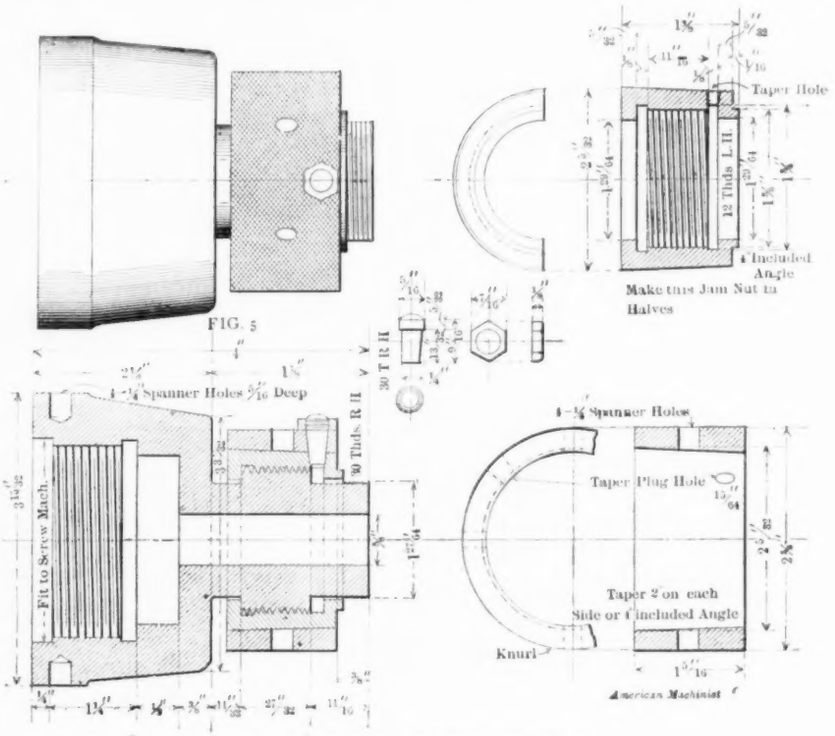


FIG. 5. SPECIAL CHUCK FOR THREADED WORK.

The jam or stop nut is threaded left hand; the pieces to be machined, right hand. The drawing shows the nut against the stop or shoulder. The work is screwed against the nut by hand and the cut forces it up tight. To remove the work, turn the nut to the left or screw away from the shoulder by means of a spanner; the machined piece can then be easily removed. The body of the chuck was made of machinery steel which was finished except the face and straight fits for the screw-

machine spindle, 1-16 inch stock being left at these points. The body was then carbonized by the usual process, it being packed in a box with granulated bone, then heated in a furnace—in this case for six hours, when the box was removed and allowed to cool.

The chuck was then put on an arbor and stock enough removed from the spots remaining to be finished to insure that the carbonized surface was destroyed; the chuck was then heated in an open fire and plunged in water.

After hardening a soft arbor was pressed in and its centers drawn until the thread for the nut and work ran true. The fits for the spindle were then made. The small hole was then ground true in the grinder, as this hole acted as a guide for the pilots on the turret tools used on the forgings. LEROY TABOR.

Milling Cutters Cast with Teeth in Place.

Editor American Machinist:

The great American hobby is the lessening of manufacturing expenses, and in the modern machine shop milling cutters and reamers made by the usual methods are a very expensive, if necessary luxury.

The method herewith submitted of making large milling cutters and reamers is a radical departure from the usual practice, and from an artistic standpoint the tools thus produced would not compare very favorably with those from one of our well-known toolmakers. But when it comes to output and quality of work these tools will not be found wanting.

In the sketches I show only the method of making a face mill, but other milling cutters and large reamers can be as easily made. The bodies of these cutters are gray iron castings. You first make a pattern of the cutter and put core-prints on the pattern to correspond to the number of teeth that you wish to insert. Fig. 1 shows a face view and section of this pattern, and Fig. 2 a section of the finished mill. You then make the required number of tooth blanks like Fig. 3. After the foundryman has molded the pattern, he inserts the steel blanks in the mold in the proper position, as indicated by the core-prints.

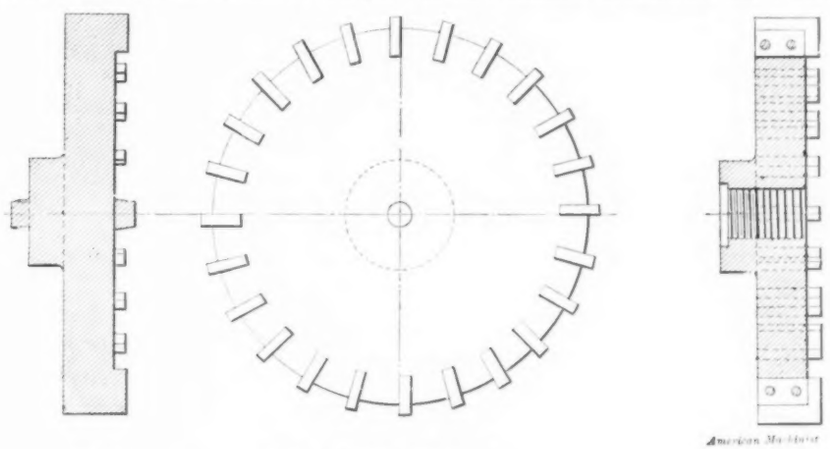


FIG. 1. THE PATTERN AND THE CUTTER. FIG. 2.

The cast iron, in cooling, shrinks and holds the teeth tightly in place; they are held as well as if integral with the casting. If you choose to use carbon steel for the teeth, you may proceed to finish the cutter the same as if it were a solid steel affair. After turning and relieving the teeth, harden and temper by the usual method. You need have no misgivings about loosening the teeth in heating the entire blank. If you elect to use a new high-speed self-hardening steel, get the steel annealed from the manufacturers, drill your anchor holes, back off and harden the teeth before casting, and finish by grinding.

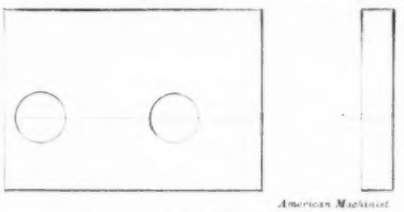


FIG. 3. A TOOTH BLANK.

Cutters of any size may be made by this method, and for results have no rivals. I would add that milling cutters on manufacturing machines, and particularly all face mills, should be ground directly on the spindles where they run. This can be easily accomplished with a portable electric cutter grinder. By doing this you can feed your face mills on finishing cuts from 1 to 5 inches per revolution of cutter and have a fine, smooth surface without the uneven tool marks you most often see.

F. C. MASON.

Different Grinding Conditions.

Editor American Machinist:

For the last year I have read nearly all articles relating to grinding published in the AMERICAN MACHINIST, and I have come to the conclusion that there are yet many problems to be solved. I have tried many of the suggestions, and have been to a considerable extent benefited by them, but also I must confess that I have obtained the best results in the majority of cases, by practices almost directly opposite to those advised by Mr. Norton, especially in regard to the speed of the work and of the traverse feed.

Probably at no time during the past five years have we been more unsettled than we are at present as to a few fixed rules to follow in finishing cylindrical parts commercially. From my own experience I have found that it has been by adapting myself to my own environments, and using ideas suggested by Mr. Norton and others, that I have been able to come to a fixed or rather daily practice to obtain the best results. I do not wish to give the impression that I believe Mr. Norton's principles are erroneous; rather I would like to know whether the same results can be obtained on other grinders besides the one bearing his name.

In the accompanying table I have taken an actual case wherein I have obtained the best results, with data as to the wheel, speed, feed, etc., and I would like to know whether better results can be obtained. Neither the wheel nor the machine used come from Worcester.

Wheel, 1" face	60 emery, Grade N
Wheel	Surface speed, 6,000 feet.
Work	Surface speed, 200 feet.
Traverse feed	3 feet.
No. pieces ground (annealed T. S.)	25
Finish diam.	1.0136 inches.
Length	7.5 inches.
Limit	.00025 small.
Finish required	Smooth and round.
Size of cut	.00125 inch.
Time (including truing, dog, sizing, etc.)	35 minutes.

I found that coarse wheels lost their sizing power, and that where shoulders had to be trued the corner of the wheel would soon wear and crumble, leaving a bad corner. In the grinding of many duplicate parts this is a great time factor. By the constant truing of the wheel and the loss of .001 inch to even .008 inch between the grinding of two pieces, it can be readily understood that much time is lost by the operator in the use of a coarse wheel in preference to the one actually used in this case.

In the trial the operator ran two machines, the pieces being roughed and finished at one setting; also there was on each a dog piece, which allowed the running by and saving of reversing. The pieces were roughed in the lathe, and calipered from .007 to .010 inch larger than the finish size. In turning the time consumed in setting the tool, finding the size and dogging the twenty-five pieces was one-half hour.

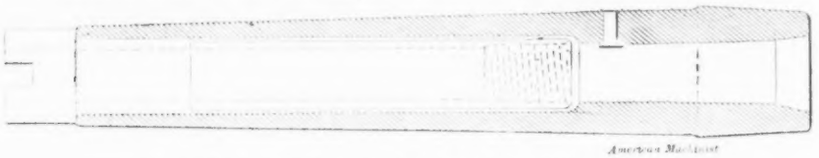
The wheel was trued once, at start, and in the grinding of the twenty-five pieces, it was found that the sizing power of wheel had lost .00125 inch or .000250 every fifth piece. The last piece was smooth and round. GRINDER.

Draw-in Chuck Adapter for the Dividing Head.

Editor American Machinist:

The draw-in chuck for the dividing head, as shown at page 153, is something no toolroom can afford to do without, if it is using any bench lathes. If it doesn't use the versatile bench lathe someone should send a missionary.

The enclosed sketch shows an adapter



DRAW-IN CHUCK ADAPTER FOR THE DIVIDING HEAD.

which has proven a good friend during several years.

The taper is long enough to reach nearly through the head, and the end of the draw-in spindle coming flush, has a slotted end, which can be turned with the end of a large wrench. This allows the head to swing up for angular work, where if the draw-in spindle extends beyond the dividing head spindle only an extremely narrow range may be obtained.

The front end is tapered on the outside to take the chuck closers, face-plates, etc., with which the lathe is equipped.

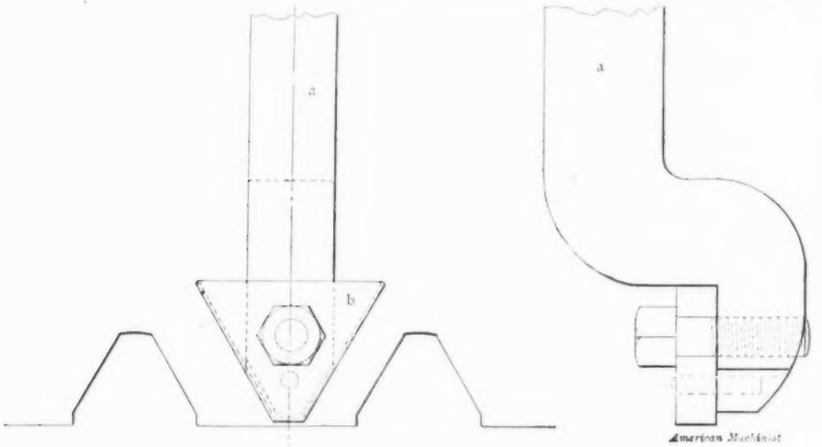
W. H. SAWTELL.

A Planer Tool for Finishing V-Ways.

Editor American Machinist:

The accompanying sketch will serve to show a planer tool which some shops are using to finish machine ways.

An inspection of the ways of the average lathe will show that many shops still finish them with side tools, getting the



PLANER TOOL FOR V-WAYS.

angle by setting over the head. This process leaves the surface covered with tool marks, which must be filed or scraped to get a suitable wearing surface, and it is not uncommon for the fitter to find that the planer hand has not done a good job and it is necessary to remove some stock the entire length of a way in the carriage to secure a proper bearing.

The tool consists of a shank *a* bent back so that the cutting surface of the cutter *b* is back of the rear line of the shank, the cutter is carefully ground to the angle desired and fastened to *a* by a bolt and dowel, as shown.

After the ways have been roughed out they are finished with the tool, which is set, as shown, the entire surface of one side of a way being covered at each pass of the tool. This process is made possible by driving the planer with a speed varying countershaft. With the cutting speed slowed down to the right point the tool will leave a surface which has the appearance of being polished and which is entirely free from chatter marks.

THEODORE.

A Convenient Jack Screw for Supporting Long Work.

Editor American Machinist:

The accompanying illustration shows a very convenient support for the end of long pieces which project from the machine on which work on them is being done. It was originally designed for use in threading long shafting on a Pratt & Whitney thread miller.

The "V" *a* is a running fit on the end of the long screw *b* which engages with the wing nut *c*, supported on the steadying flange *d* having a hole to fit the screw and threaded to fit the pipe *e*. The pipe is threaded to the base *f* and has a guide bushing *g* pinned to its inside. A plate *h* is for use in place of the "V" *a* when machining long flat work.

JOHN KNOWS.

Intelligent Guessing.

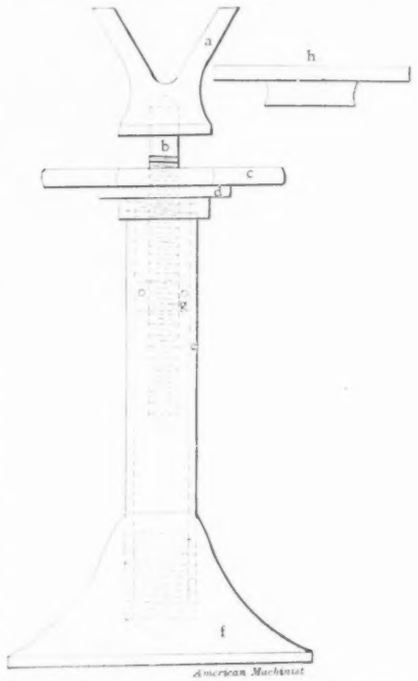
Editor American Machinist:

There is probably nothing either more important or so important to the engineer as judgment—quick, keen, sound judgment.

I go into the shop to measure a casting and the foreman comes over to speak to me. Just then the manager happens along and, speaking to no one in particular, asks, "Will that pump do for our oil system?"

I look in the direction indicated and see an old, dusty, unused, belt-driven pump. Before I have time to think twice, the foreman replies, "Certainly; the capacity is really greater than we need."

He judges from experience, for he has seen a similar installation, while I am unable to judge at all. Once in the drawing room again, I figure it out carefully to see whether he was right or not, for



JACK SCREW FOR SUPPORTING LONG WORK.

I feel humiliated. If I am wise I learn something and next day can judge pumps with him till he is tired, for I know that $d^2 \times 4$ gives me the number of gallons (very nearly) per minute at 100 feet per minute piston speed, and can rely on my native store of judgment whether to increase this speed or not.

A stock of similar approximate formulas are invaluable to the man who must learn to be "practical." An apprentice once beat me on a quick guess at the weight of a lot of cast-iron balls. On the spur of the moment I could not, for the life of me, think whether the volume of a sphere was $\frac{4}{3}\pi R^3$ or $\frac{1}{6}\pi D^2$, or just what. But I wasn't really given much time to think before he announced the result. His formula was $\frac{D^3}{8}$ —not exact, but good for a guess. I have since then frequently found the approximate formula for volume of sphere

$$V = \tfrac{1}{2} D^3,$$

or half that of its circumscribed cube very useful for quick estimates.

There are numberless such simple, easily remembered substitutes for exact formulas to aid the guesser. In the engineer's other

class of formulas—his exact mathematical ones—his inborn judgment is much in evidence when he never uses a (to him) new formula without reducing it to as simple a form as possible, eliminating or reducing to *one* all constants, and then, if the results warrant it, putting it down in his note book. I dare say that I am not the only one who has reduced certain formulas a dozen times before having judgment enough to set down the result in an easily handled form.

Nothing, to my mind, is a better substitute for experience than the persistent habit of finding some easily remembered, practical equivalent for formulas we work out. In this way we not only get in the habit of continually looking for "short-cuts," but we can partially atone for our lack of judgment, knowledge and experience. ROY H. SMITH.

The Training of the Mechanic.

Editor American Machinist:

As most of the articles which have appeared in the mechanical journals touching on the training of the mechanic have been written by men holding very decided views, and as I have had an opportunity to view the subject from different standpoints, it seems worth while to add my mite to what has already been presented.

The average man whose education is somewhat limited and whose ambitions, on account of his associations and environment, are also limited, is very prone, when he sees a young technical graduate who has decided to commence at the bottom and work up, or who on account of certain existing conditions is obliged to roll up sleeves and go to work, but who cannot do everything he can do, in the same time, and in the same workmanlike manner, to condemn the whole system of technical training.

Were he to make an investigation he would find that the amount of actual shop training which the young technical graduate received was very limited, and that this limited time was divided among various branches.

It is not the office of the technical school to teach trades, although one might think this the case when considering the claims occasionally made, claims which are unreasonable and, in the end, tend to react to the harm of the school. I do not claim that a trade cannot be taught in a technical school; on the contrary I think a school *properly equipped* and having proper instructors the ideal place for a young man to learn the trade of his choice.

However, there might appear to be serious objections to this scheme. In the first place, the average young man learning a trade is actuated by a desire to earn money for the purpose of supporting himself while learning, as well as to equip himself so as to be able to earn a living for himself and his future dependents. The first object cannot be met by a school and, consequently, he goes into the shop to get his education, and at the same time earn enough not to be dependent on others.

The technical school claims to educate its young men in a manner that places them on a higher plane than that occupied by the average mechanic, and for this reason its energies are devoted to giving the student an education that fits him to occupy a position higher than that of the mechanic. What is the chief thing necessary to a young man who intends to occupy a superior position? According to my experience, it is the ability to think for himself and to think quickly and correctly. The training received in the school fits the young man to think and reason for himself. In my dealings with boys and men, I have always found that the one who had the faculty of thinking for himself was the one most likely to advance; in fact, when a man of average "spunk" gets to thinking you cannot hold him down.

The school teaches the young man that he is superior to a position as a mechanic and that the education he is receiving fits him for a superior position, and this in itself is worth all the education costs, while the advanced education the student receives fits him to occupy the position which he is taught to believe belongs to him.

I remember having in my employment at one time a young man who, while apparently bright and smart, made very little progress. His widowed mother was very anxious that he should learn the machinist's trade and thus be able to help her as well as to take care of himself. She thought that, because his father had followed that trade, the son must necessarily be specially adapted for it. I tried to interest him in his work by showing him the opportunities he was missing by his carelessness; then I told him his mother was in a measure dependent on him and at some time would be altogether dependent on him, but all to no effect. Finally, threats of discharge were resorted to, but to no avail. However, under the circumstances, I did not wish to discharge him, at least not until I had tried every resource I could command.

As he was naturally smart and showed a disposition to be a leader among the boys in anything that did not savor of the shop, I concluded that I might possibly accomplish my purpose if I went at him in a manner entirely different from the one I had been pursuing.

Calling him to my office, I told him I had my eye on two boys in the shop, who, I felt certain, were fitted by nature to occupy positions of trust; but that a certain training was necessary in his case if he desired to occupy any position at all. I told him I was positive he could, if he so desired, occupy a good position, and that I had already planned giving one of my apprentice boys partial charge of some of the work in the manufacturing department, the duties being to occasionally gage the work and look after the time of a few boys, in connection with his regular work as an apprenticed machinist.

The change that took place in that boy was marvelous. He told me a few days after the conversation mentioned that he wanted that position, and that he was going to get it if it was possible, and he did get it. A short time after, I showed him, in as kindly a way as possible, his weaknesses and limitations; how his lack of education would stand in the way of his getting and keeping positions that nature had fitted him to fill. I also told him that it was possible for him to attend evening school while it was in session, and during the balance of the year study at home, getting such help as he needed, and thus fit himself to occupy a good position. He did as advised, and to-day occupies a responsible position at a good salary.

Why this change? He was convinced that he was capable of doing something, and was ambitious to do it.

Need the man working as a tradesman despair when he realizes his lack of knowledge and of training? Decidedly no. Knowledge is a very necessary part of our capital in trade, and the opportunities for getting it are by no means beyond the reach of the ordinary man. Text books cost but little, and libraries are accessible to nearly everyone, while the benefit derived from a course in a correspondence school, provided it is persistently followed, is beyond all doubt. The student of such a school not only gains knowledge but he learns that he is capable of something better than his present means of livelihood, and when a man knows these two essentials he is bound to find a place.

Our apprenticeship system as a whole is extremely unsatisfactory. I am aware that a *few* shops, realizing the lack of skilled mechanics that must necessarily face them in the near future, are endeavoring to do something toward meeting this condition; but as a rule our apprenticeship system is a mere scheme on the part of the manufacturer to get a few boys to do certain work cheaply, while representing that they are teaching them a trade. I feel that far-sighted managers of shops employing skilled labor must realize that it is time something was done to relieve this condition which they must soon face. As the demand for intricate automatic and other complicated machinery increases, just in the same proportion must the demand for educated skilled labor capable of thinking increase; and how is this demand to be met? Not from the graduates of the technical schools, unless they learn the trade after leaving school, and that would be undoing the intention of the school, which fits them for engineering positions rather than those of mechanics.

The atmosphere of many of the shops where the "apprenticeship system"—so

called—is in vogue is detrimental to young men who are qualified by nature to work their way up. In the first place, a spirit of distrust is planted in the young man's breast as soon as he learns the true attitude of the concern who claim to be solicitous as to his welfare, but who, he soon learns, care nothing for him beyond what they get from him. The fact that he is every day in contact with men whose only interest is to have 6 o'clock and pay day come has a bad effect. I know that the number of honest men is far greater than the other; but a boy naturally gravitates to the dissatisfied, fault-finding man when *he* finds everything is not as he expected to find it, and the influence of one such man is very apt to be lasting.

I think I am safe in saying that there is a field, and a broad one, for schools where trades shall be taught, and when I say trades I mean that not only shall the student be taught to make things from wood or iron, but that he shall be taught the necessary mechanical drawing and mathematics rightly planned to give him the necessary things in a practical way. The men in charge of such an institution must be those who love boys and have their interests at heart. They must be thoroughly practical in their respective lines, capable of imparting what they know to others, and they must be as clean and true as they would have the young men whom they are guiding become.

I heartily believe in the training given in our leading technical schools; but it does not aim to fit our young men for tradesmen. Why not have a place where we can educate our skilled workmen, foremen and superintendents of the future?

MECHANIC.

The largest factory for any purpose in New York city is said to be that of the National Biscuit Company. Its buildings are six stories high, and recent additions bring its floor area up to 21 acres.

14-Inch Hydraulic Boring Lathe.

The half-tones illustrate a very heavy machine built by the Niles-Bement-Pond Company for boring gun forgings, marine shafts and ingots generally. It will take in a shaft 60 feet long and 30 inches in diameter, and bore a hole out of the solid 12 inches in diameter the full length, or 14 inches for a short length.

Two boring bars are used, one at each end, while the work is held in a hollow spindle or rotating chuck. Two revolving ring steady rests on each side of the center chuck support the work. The feed pressure required to do such extremely heavy work is so great that it becomes impracticable to feed by rack and pinion or screw. For this reason the boring bars are fed in by hydraulic pressure. The boring bar itself is clamped in a head by hydraulic pressure, in addition to lever and toggle joint. The hydraulic pressure against the piston is 720 pounds per square inch, giving a total pressure of 200,000 pounds against the piston.

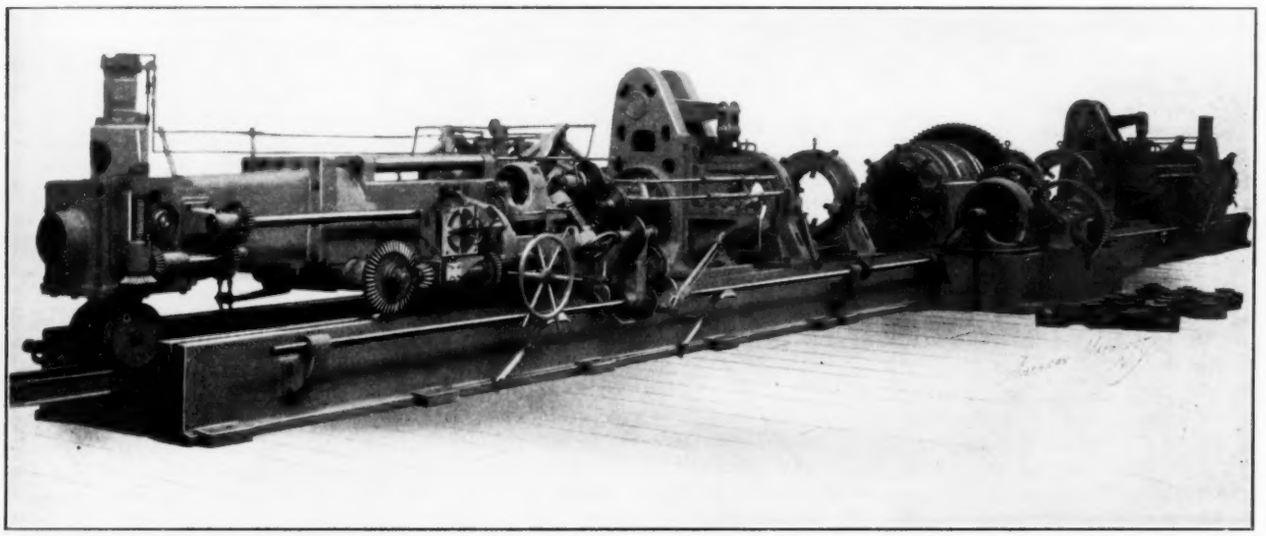


FIG. 1. HYDRAULIC BORING LATHE.

It is obvious that an arrangement like this would allow the tool to gouge into the work should the metal be soft, and, generally speaking, would not offer any means of control for the feed. In order to provide for this control, the rear end of the piston—that is, the end projecting backward from the cylinder—is cut to form a very steep pitch screw. A nut revolving on this screw has a worm-wheel of very steep pitch cut on its outer circumference. The angles of the screw and the worm are so chosen that the pressure against the piston will be able to rotate the nut, and the movement of the nut will turn the worm, but a relatively small amount of resistance on the worm will entirely check this movement. This resistance is provided by ordinary feed mechanism taken from friction disks, which have the necessary change gears, etc., to enable the operator to get any feed desired. It will be seen, therefore, that the hydraulic cylinder furnishes the pressure and the feed mechanism regulates the amount of feed, but that the feed mechanism is never subjected to the heavy strains due to the exceedingly heavy work done on the machine.

The machine is driven, through the gearing clearly shown in the illustrations, by a 100 horse-power Westinghouse motor arranged for 220 volts. This motor allows of some speed variation by means of field control, and the range of speed is increased by change gears, which are also clearly visible in the engravings. The main driving gear, which is bolted on to the hollow spindle or chuck, has 75 teeth, is 4 inches pitch and 10 inches face. It is a steel casting, as is also the spindle. The piece to be bored is chucked by means of set-screws, of which there are eight, 3½ inches in diameter, on each side of the machine.

The feed is taken from the last driving shaft, and is transmitted to the two cylinders by means of the long shaft running alongside and in front of the bed. This shaft is supported by drop bearings and is made in three pieces coupled together. The change gears and friction disks give a wide range of feeds.

Hand feed is obtained through the medium of a hand-wheel, and before using this the friction disks and the feed driving shaft are disconnected by means of another hand-wheel. A 5 horse-power motor gives a rapid motion to the train of gearing shown at the front of the cylinder, whereas the feed mechanism gives a slow motion to this train. A clutch lever throws in either one or the other, and thus gives either a slow feed or a quick traverse of 10 feet per minute to the piston, and, if the cylinder is clamped to the bed, also to the clamping head, or, if the clamping head is clamped to the bed, it gives this quick traverse to the cylinder. This quick traverse is really gotten by means of hydraulic pressure in the cylinder, and

the small motor simply regulates the speed. A hand-wheel gives adjustment to the piston and clamping head, or to the cylinder should this latter be clamped to the bed.

The parts to be moved being very heavy, it is obvious that a great number of turns of the hand-wheel are required in order to move by a small amount either the clamping head or cylinder; consequently, if the cylinder is traveling at a rate of 10 feet a minute, by power, this hand-wheel, if fast in place, would race at a speed so high as to be dangerous to the operator. For this reason the hand-wheel is mounted in such a way that it is released on its shaft or stud if either the quick traverse or feed is thrown in, and is only connected to the mechanism which moves the cylinder when both feed and quick traverse are out of action, thus avoiding all possibilities of danger.

The train of gearing moved by the motor can be connected to the cylinder mechanism, or it can be connected to the shaft, which, by means of suitable gearing, drives a grooved roll which is not visible in either illustration, but which is held in a floating frame inside of the rear part of the cylinder casting. This floating frame carries the hydraulic cylinder, the piston of which is connected to the grooved roll, while the cylinder casting is connected to two other rollers under the bar. By admitting water to this cylinder the inner boring bar is clamped between the rollers, and by moving the grooved roll a quick traverse motion is imparted to this inner bar.

In operation the machine first forces 4 feet of the boring bar into the work. By that time the clamping head is up to the work and 4 feet distant from the cylinder. The quick traverse is then brought into play and the clamping head is pulled back until it comes up to the cylinder. The inner boring bar is then pushed 4 feet farther forward, and the boring bar is once more forced into the work another 4 feet. This alternate action of forcing the bar into the work and drawing the clamping head back so as to take a new grip is repeated until the center of the work is reached.

In setting up for new work, if the cylinder and clamping head are near the center of the machine and are wanted at the extreme end of the bed, the clamping head may be clamped to the bed and the quick traverse utilized to push the cylinder back 4 feet; then the cylinder may be clamped to the bed and the clamping head released and run back 4 feet. This cycle of operations is repeated as many times as necessary. The inner boring bar can, of course, be withdrawn in one operation.

The piping for the different cylinders is supported at the rear of the machine on brackets or on rollers where the piping slides; and there are handles for operating the various valves, both at the front and rear of the machine.

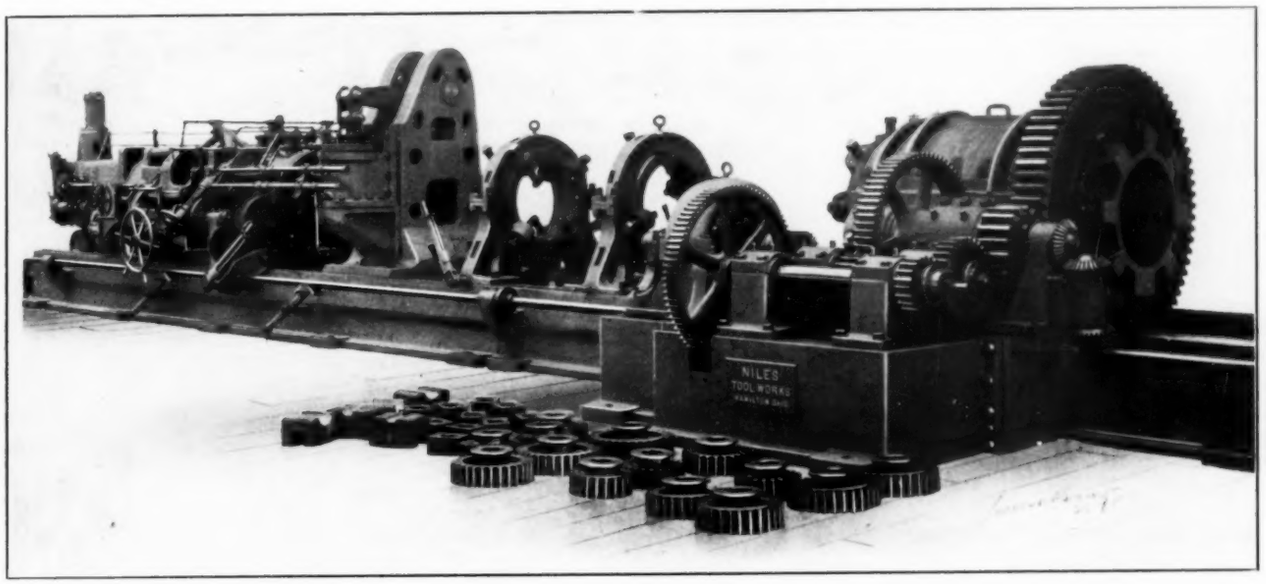


FIG. 2. HYDRAULIC BORING LATHE.

The Technolexicon of the Society of German Engineers.

The universal technical dictionary for translation purposes, in English, German and French, the compilation of which was begun in 1901 under the auspices of the Society of German Engineers, has received help up to the present time from 363 technical societies at home and abroad: fifty-one of these are English, American, South African, etc.; 274 German, Austrian and German-Swiss, and thirty-eight French, Belgian and French-Swiss societies. Of firms and individual collaborators 2,573 have promised contributions.

The excerption of texts in one, two or three languages (hand books, pamphlets, business letters, catalogs, price lists, etc.) and of the existing dictionaries has yielded 1,920,000 word-cards so far. To these will be added within the next two years (by the middle of 1906) the hundred thousands of word-cards that will form the result of the original contributions—those already sent in and those still expected—of the 2,573 collaborators at home and abroad, when the editors in Berlin have finished them for the press. Specially made handy note-books had been placed at the disposal of the collaborators to write their collections in, of which 317 have come in filled so far.

All the outstanding contributions will be called in by Easter of this year, 1904. The collaborators are therefore requested to close their note-books or other contributions—unless a later term has been especially arranged with the editor-in-chief—by the end of March and to forward them to the address given below. As the printing of the Technolexicon is to begin in the middle of 1906, delayed contributions can be made use of in exceptional cases only up to that time.

The editor-in-chief will be pleased to give any further information wanted. Address: Technolexicon, Dr. Hubert Jansen, Berlin (NW. 7), Dorotheenstrasse 49.

Notes on Crane Design—Combined Hoisting and Turning Gear.

BY A. D. WILLIAMS.

Machinery devised to handle heavy pieces of work occasionally gives rise to peculiar gearing problems. The accompanying sketches show how one of these problems was solved, and represent diagrammatically the hoisting train of a forge crane. This machine had five motions, which could be operated in either direction, independently or in any desired combination. They were bridge travel, trolley traverse, hoist, rotation of hoist about a vertical axis, and rotation of the piece be-

ing handled about its horizontal axis, each motion being driven by its own electric motor. The hoisting train shown was mounted upon a turntable carried on the trolley.

The work *a*, Fig. 1, was carried in the bight of an endless chain which was supported by a pocket wheel *b* on the lower block. This pocket wheel was hung on springs *c* beneath a pair of sheaves with a pocket wheel *d* between them, which hung in the bights of the hoisting chain *e*. An idler gear *f*, carried by links *g*, was driven from the upper pocket wheel *d* and operated the lower pocket wheel *b*, turning the work through the sling chain.

The hoisting train was so arranged that in hoisting the pocket wheels *h* rotate in opposite directions, taking in or paying out the chain equally. When the work is to be turned, the turning motor is started, and this is so geared that it causes the pocket wheels *h* to turn in the same direction, paying out chain on one side and taking in on the other, and thus turning the upper pocket wheel *d* of the lower block, and through the idler *f*, pocket wheel *b* and sling the work.

The buffer springs in the lower block are to relieve the crane from impact stresses due to the hammer falling on the suspended load.

Fig. 2 shows in horizontal section the method of operating the pocket wheels *h* of Fig. 1 in the same or the reverse directions at will. The hoisting motor is connected to shaft *a* and the turning motor to shaft *b*. Shaft *b* being stationary, the turning of *a* turns shafts *c* and *d* in opposite directions through gears *e* and *f*. Shafts *c* and *d* are keyed to pinions *g* and *h*, which, through idlers *i* and *j* rolling within the stationary annular gears *k* and *l*, turn disks *m* and *n* and the attached pocket wheels *o* and *p*, corresponding to *h*, Fig. 1, in opposite directions.

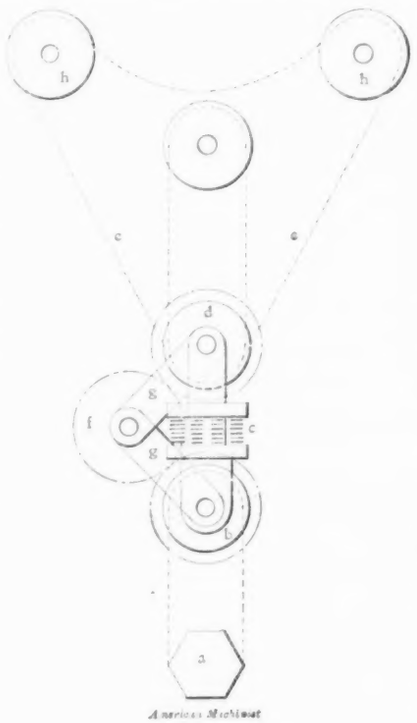


FIG. 1. CRANE SUSPENSION.

In turning the ingot, shaft *a* is held stationary and the turning of *b* turns *k* and *l* in the same direction through the idler *q*. Shaft *a* being now stationary pinions *g* and *h* are also stationary and the turning of *k* and *l* in the same direction causes *i* and *j* to turn about *g* and *h* in the same direction and carry with them *m*, *n*, *o* and *p*.

It is, however, not necessary that *a* should be stationary while turning the ingot or *b* while hoisting it. The rapidity of operation of either motion is unaffected by the simultaneous operation of the other. In this case the motion of *p* and *o* will be due to the differential action of one train upon the other; when *p* is retarded *o* is speeded up correspondingly and *vice versa*.

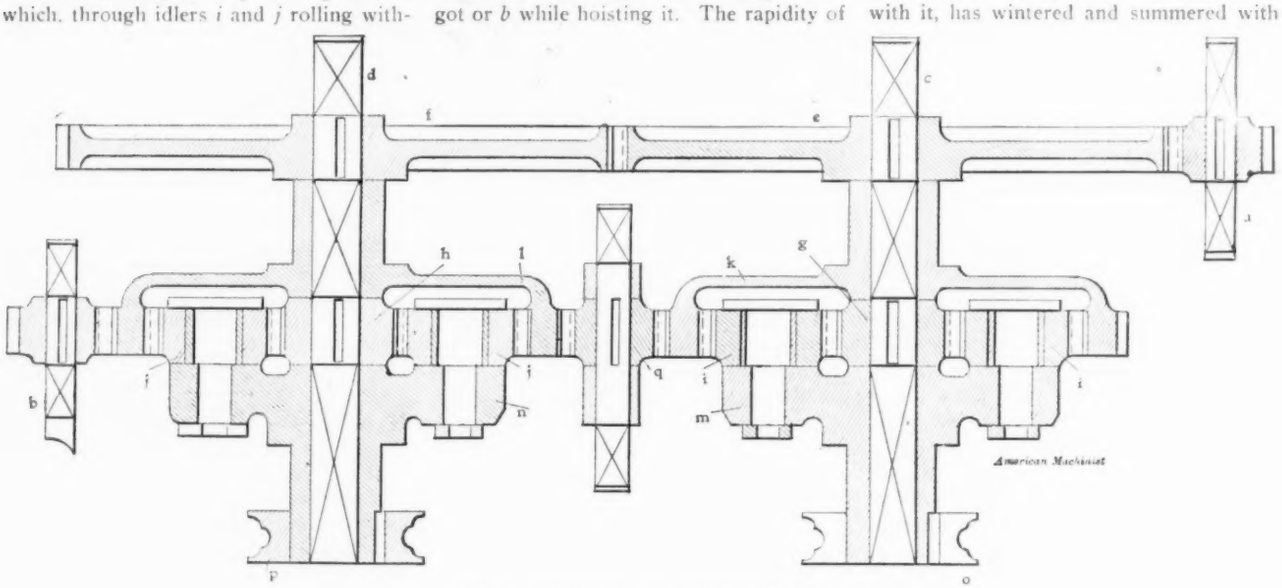


FIG. 2. HOISTING AND TURNING GEAR.

Echoes From the Oil Country—Trying to Fit the System to the Shop.

If any remark of mine has, for want of being expressed properly, led anyone to think that I am opposed to the card system, or to cost keeping, or to any other of the modern improvements, I wish to say that the remark has not conveyed the idea that I intended it should. I am always in favor of everything that helps the the man who owns the machine shop, the man who works in the machine shop, or the man who buys the product of the machine shop.

Since I began work as a machinist it has been my aim to get results, and to use the best means at my command to get them. I have always tried to keep posted as to what are the best means. While I have been doing this I have always also had in mind that there were two sides to things, and I have seen one of them quite plainly.

A man came into the shop with a wonderful corn cure. It was the best thing in the world. It would remove the most obstinate corns. A failure was impossible. I had no reason to doubt the truth of any of the statements that the man made, but I did not buy; I had no corns.

I might as well hold up both hands right now and admit that I am not enough of an expert to sit in judgment on any system of cost keeping, or to put my name to a statement to be used in bringing the system to the attention of people needing something different from what they have. That is one side of it. There is another side.

When a man has started in with a little "corn-sheller" shop and has grown up with it, has wintered and summered with it, has sat up with it nights and holidays, has watched over the company it keeps, knows its constitution and the tendencies of the climate that it was born and raised in, it may be possible for him to understand it and what it can stand.

I am not a shoemaker, but I know when a shoe fits me, and no matter what the quality of the shoe is, as a shoe, if it does not fit me, to me and my needs it is a failure. A shoe that fits would have to be of extremely poor quality not to be better than the best that could be made that did not fit. Like answering the conundrum which I gave some weeks ago, there might be some who would not choose the same pair of shoes that I would.

I am well aware that I am so close to this shop that there may be things that I do not see about it as well as a stranger might; but, then, I have seen systems where I have thought the originators of them were in the same fix in regard to them.

Since the days when the men used to put the record of their work down on a slate I have been trying to have shop records that would give all the information that could be made use of. I do not know of a modern system that has slates as the foundation, but where the foreman was working with two or three men, knew every job that came in, knew just what was done on it, and entered the record of each slate into the day book himself it did very well, especially as the shop was entirely on repair work where no two jobs were alike, and the largest of them was only repairing a small engine or a pump.

The worst feature of it was the lack of permanency of the original records made by the men, and when the business grew a little the slates had to go. Different things have been tried with more or less success, and I have been helped by many things that have been shown of the ways others manage their systems. There has been one feature of my systems that I have not been pleased with, and that is that it took an expert to handle them. For a long time I had to be that expert myself, and along with a number of other things that I seemed to find it necessary to do I did not have time to get as much out of any system as there was in it.

It is from practical experience that I know that the amount of work which a man can do at a desk is limited, and I find also that the number of hours that he can keep at it is limited.

It might be conceited in me to think that I could learn by reading, studying and trying, and thereby finally get a real good system, and so an expert, up in the best practices of the best shops, was procured. I welcomed him for two reasons: here was a man to take that part of the work off of my shoulders, and here was an opportunity to gather in knowledge first hand from one who knew. I gathered knowledge all right enough.

The very first thing that I learned was that the shop was all wrong in its way of doing things. There should be a rough stores room, and a finished stores room. There should be a system of orders and these orders should be numbered. No work should be started before it was given an order number, and an order had been written for it. All work done by anyone should be charged to the corresponding order number. All stock, either rough or finished, must be delivered only on order. By a proper filling in of wage rates, cost of material, and an equitable proportion of unrevealed labor (called in many systems unproductive labor), the flat labor costs would be known. After this all that would be necessary to get the real cost would be to put on this particular job its share of all the other costs, and expenses of the establishment. As the prices at which "corn shellers" and their parts can be sold is controlled somewhat by competition, the price of hogs and the freedom with which hens are laying, we could not change them too abruptly; but we could have the satisfaction of knowing how much we were allowed to make or lose, as the case might be, *when we followed the above outline.*

It did not take much of a head to see that the most important points in this procedure are those of getting the correct amounts of concealed labor, and other costs and expenses charged against the job that is up for judgment.

There is a famous receipt for cooking a hare, which is in place under some conditions: "First get your hare." If you are smart enough to do that, it will not trouble you to cook him in a palatable way; if you cannot catch the hare it is a waste of time studying how to cook him. There are shops and conditions where it is just as hard to get a proper "burden" on each job as it is to "guess" at the whole cost of the job, and a man who is competent to do the first may be just as competent to do the last.

The expert whom we had did not stay very long. The "powers that be" did not see fit to reconstruct the shop around a strange system. The aforesaid "powers" were willing that the shop do the work in any way the cost expert desired, subject only to the proviso "that it does not interfere with getting out the work. We must get out the work in the way our customers want it, and when they want it." As that proviso had been the controlling factor in all of the plans of the shop, it meant that only minor details could be changed, and these changes were not the ones needed to give life to the system.

As to the methods of putting in the time, we were willing to use any reasonable plan, although there was one which I did oppose. Under the methods in use it was possible to tell who did any distinct operation on any piece; to tell how many he did at the time, and how long it took him to do them. This information it was desired to continue to get. The various sized machines built had letters to distinguish one size from another, and the pieces each had a number, and it was proposed to get out sheets on which every separate operation would be given a number. All the man would have to do would be to find one of these sheets (that would be easy, as they would be too large to hide anywhere) and after finding the number that corresponded to the operation that he had performed, he would use that instead of using poor grammar to describe it.

Name, John Doe. Date, Nov. 24, 1902.

		Hrs.	Min.
Drilling base holes in B frames,	2 done	1	30
Facing G levers,	7 done	3	50
Countersinking oil hole in 20" pulley for stock,	1 done		05
Helping on crank lathe,		1	
Dr'g for bolts 4 18" pulleys,	not done	3	20
Cleaning drill,			15
		10	

This is something like a time sheet where a man did not have many changes. Below will give some idea of how the proposed one would look.

Workman's No., 13. Date, Nov. 24, 1902.

Operation	Symbol	Number	No. worked on	No. done	Hrs.	Min.
22	B	7	2	2	1	30
37	G	78	12	7	3	50
53	AE	274	1	1		05
00					1	
25	AE	263	4	0	3	20
01						15
					10	

The sheets here shown will perhaps explain it more clearly, although it was further proposed that in the latter case there should be as many time sheets as the man had jobs in the day. This was to help in the sorting. In the case shown the man would have six sheets.

Thinking of applying such a system to our conditions, I will say that as a means of concealing what is taking place in the shop, I do not think it could be improved upon. It would also prevent anyone trying to check over the cost clerk's work whenever he and the superintendent did not agree as to the correctness of the results obtained.

Wouldn't it be joyful to hunt over 1,800 slips after pay day (that is the number we would need to use in two weeks, according to our estimates) to find out whether John did work ten hours on Saturday or only five? While all *good* shops have a time clock for the men, we are still out of that class.

One of the nightmares of my life is caused by thinking of the awful fate that is in store for the shop that will persist in doing without the great number of things that I am solemnly informed no good modern shop can get along without. The lack of any one of them is enough to doom it to mechanical perdition. I know that there are dozens of these absolute essentials that it is not provided with.

If I could have the cost-keeping system

as a thing by itself, and if it could be worked in any way that was desired without any reference to the rest of the shop, things would not go so slow along that line; but there is one lesson that has been burned in on me, and it has been burned in deep, and that is that there is not a man, machine, operation or system in the shop that stands entirely alone. Each one, to be valued rightly, must be viewed as part of a whole. Some of the most expensive and annoying mistakes of my life have been caused by the overlooking of this fact.

It is right here that I am willing to go on record with the advocates of systems and a whole lot of other things. My judgment as to whether his good system, or his good plan of paying men, or his good machine will fit in and harmonize with the rest of my systen s in a paying way is better than an outsider's can be, if for no other reason, because I come nearer to knowing all of the conditions than he possibly can.

If I see it will not fit, then I must decide whether it is worth the cost of the changes that it will necessitate, and here again my judgment is best, for I can understand more nearly what these changes will have to be. When I know that with the most careful preliminary investigation the effects of changes are frequently much more far-reaching than was supposed when the changes were first planned, and when I am suffering from mechanical scars and lameness caused by ill-advised changes, I hope my friends will understand my caution, and see that I am viewing these outside improvements simply as they look viewed from my shop and shop surroundings.

I perceive that there is such a thing as too much system, even for a big shop, and that there are others besides myself who think that the danger (at least for small shops) is in getting too much rather than too little. I would dislike to get our modest establishment arrayed in a system that would make my discerning mechanical friends think of that beautiful story of Aesop's, about the jackass that arrayed himself in the lion's skin. As I remember the story, there is nothing to show that it was not a first-class, up-to-date skin. Perhaps some enthusiastic dealer thought it was so good that it would change anything that it touched into a lion, and so prevailed on the weak-minded ass to put it on. W. OSBORNE.

A Special Worm

BY WALTER GRIBBEN AND E. S. CLARK.

The worm shown in Fig. 1 was made to fit a 16-pitch spur gear, that was the main spindle gear of a small engine lathe, and was to be used as part of a circular dividing rig. As the gear was already in existence, the worm shaft could not be set parallel to the plane of the gear, but had to be set around at an angle so that its thread would run smoothly in the teeth of the gear. This, however, is quite in accordance with Prof. Sweet's views, and is closely analogous to the Sellers worm and rack. Also, the *normal* circular pitch of the worm would have to be equal to the circular pitch of the gear. Sixteen diametral pitch is equal to .19635 circular pitch, and 1 divided by .19635 gives 5.093 teeth per inch of rack, or threads per inch which the worm would require to have if it was set parallel to the plane of the gear.

But when the worm shaft is slewed around at an angle, it will require a coarser thread than 5.093 per inch. This angle is governed entirely by the relation between the pitch of the worm and the pitch of the gear with which it is to mesh, the latter divided by the former giving the cosine of the angle between worm shaft and plane of gear. Or we may obtain this cosine by dividing the threads per inch of the worm by the teeth per inch of a rack that is the same pitch as the gear.

Knowing the angle at which the worm shaft stands, we can subtract it from 90 degrees to get the angle of pitch line helix. When the angle of this helix is known, its tangent divided by the threads per inch of the worm and also by π gives us its pitch diameter, the angle at which the worm shaft is set and the diameter of the worm, being both determined by the pitch used for the worm, and this, in turn, is determined somewhat by the change gears at our command.

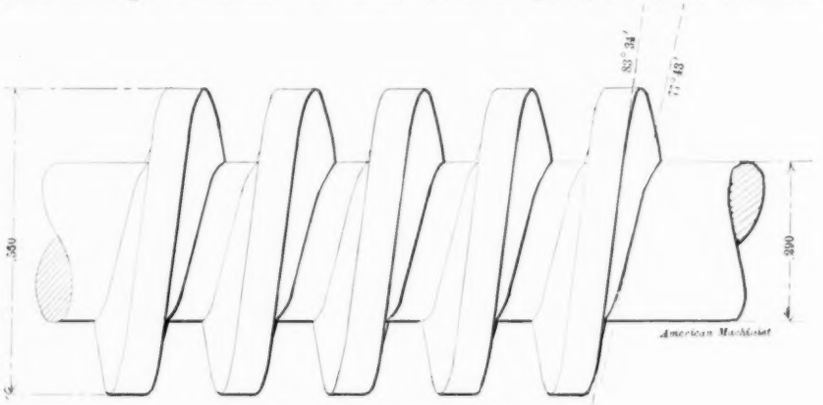


FIG. 1. THE FINISHED WORM.

At first it was thought 5 threads per inch would do, but when the computations were made it was found the worm would be about 3-16 inch diameter at the bottom of the thread, which was altogether too small. Then 2 per centimeter was considered, but this called for a worm about 1 inch outside diameter, which was larger than could be conveniently used on a gear having a face only 9-16 inch wide with a ¼-inch belt flange next to it. A thread of 2 per centimeter is equivalent to about 5.08 per inch, which was too fine, and 5 per inch was too coarse, so something between these two would probably do the trick. The lathe on which this worm was to be cut was built by the owner for his private use, and was especially designed to admit of a great many unusual operations being performed without much trouble. The change gears are of the old style, and are changeable from spindle to screw, or intermediate stud, as may be desired, and they may also be compounded to almost any extent. In modern lathes having the change gears nested in a group, it is generally impossible to obtain fractional threads without resorting to some other device. As the lead screw was 10 per inch, by putting a 64 gear on the screw and a 127 gear on the spindle, it would give a thread of 5.04 per inch, and this was what we finally used. The 127 gear was one of a translating pair for metric threads.

Dividing 5.04 by 5.093 we get .9896, which is the cosine of 8° 16′, which is the angle between our worm shaft and the plane of the gear. Subtracting this from 90° we get 81° 44′ for the angle of the helix where it cuts the pitch cylinder. Dividing the tangent of 81° 44′ by 5.04 and also by π we get .435 inch for the pitch diameter of the worm, and adding .125 inch, the regular addendum for 16 pitch, we get .560 inch for the outside diameter. Subtracting from this twice the cutting depth for 16 pitch, or .270 inch, we get .290 inch for the bottom diameter of thread.

In order to know what clearance angles to give the sides of the worm tool, it was necessary to determine the helix angles at the top and bottom of the thread. By multiplying the outside circumference by 5.04 we get the tangent of the helix angle at the top of the thread, which is 83° 34′. In a similar manner we find the helix angle at the bottom of the thread to be 77° 43′.

Figs. 2, 3 and 4 show three views of the thread tool, which was filed on the end of a piece of lathe tool stock, without any forging. The top face of this tool was filed 8¼ degrees out of level, so as to be at right angles to the pitch line helix, and as the worm was to be left-hand, the side of the tool next the headstock had what might at first appear to be 1½ degrees negative clearance, but this in reality cleared the outside helix by about 5 degrees. The side of the tool next the tailstock had to clear the bottom helix about

5 degrees, so it was made 72¾ degrees with the horizontal. In filing up the sides of the tool, the plane of the protractor was held at right angles with the shank of the tool, both vertically and horizontally. In the plan view of the tool, the sides, of course, are made the usual angle of 29 degrees, the plane of the protractor in this case being held parallel to the bottom surface of the tool shank.

The point or end of the tool was given 5 degrees clearance, as shown, but in the actual cutting this proved to be insufficient. The end of the tool was 1-16 inch wide, and was, as shown in Fig. 3, at an angle of 8¼ degrees from the horizontal. Consequently, when set with the middle of this width at the hight of the centers, the right-hand corner was below and the left-hand corner above the center line of the worm. This worked all right until the cut was down to within about 1-16

FIG. 2

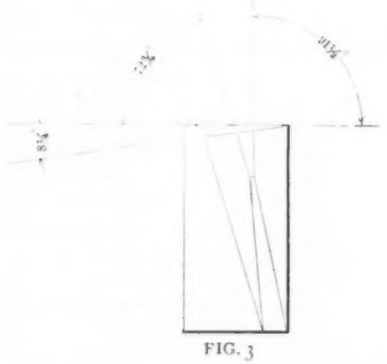


FIG. 3

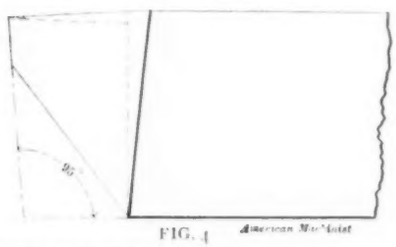


FIG. 4

TOOL USED FOR CUTTING THE WORM.

inch of size, and then, the diameter at the bottom of the worm being pretty small, there was no longer any clearance at the left-hand corner, the tool caught in the work and the point was broken. It was then reground and given more clearance at the point, after which it gave no trouble. The stock used for the worm was annealed Crescent Special, and the tool was made of Crescent Extra, hardened and drawn to a dark straw color.

As the diameter at the bottom of the thread when finished was only .290 inch and the thread was 5.04 per inch, we had a very weak piece of stock to work upon, but by using the follow-rest to support the work, very little trouble was experienced in the cutting. Some tendency toward roughing up the sides of the cut was found, but this was overcome by taking very light cuts when nearly finished. We were told that tallow used as a lubricant in cutting work of this character gives a better finish to the thread, and is in many ways ahead of oil, which was the lubricant used on this job, but as this information came after the work was finished, we had no opportunity to try it.

The Old Way of Making Machinists.

George H. Holmes is telling in *Fibre and Fabric* how he became a "boss weaver" and from that developed into a "master mechanic." In the following he tells how his boss weaving ended and his machine-shop life began:

Things went along very smoothly and pleasantly until one day the superintendent interfered with one of my help. That settled it at once; I quit, and all the influence that was brought to bear to induce me to reconsider and go back to work had no effect. This was on a Friday. The next day I made up my mind to run down to Norfolk, Conn., and visit over Sunday with my brother-in-law, Mr. Frank Andrews, a machinist. On Monday morning he introduced me to his boss, Mr. G. B. Munn. I had not the slightest thought of looking for or accepting a situation in that or any other machine shop. We had a social talk. He inquired all about my business, what wages I could make, etc., and finally asked me how I thought I should like the machine business. I told him I thought I should like it first rate. He asked what I knew about it, and I told him nothing except to run a machine after it was built. "Well," said he, "I should like to hire one man that knew nothing about the business. I have several here who said they knew all about it, but who are very poor apologies for machinists, and should like to try one who don't know anything about it." Now I supposed, of course, this was all a joke, for the want of something else to talk about to kill time; but I said to him, "What will you give me to come here and work for you?" "Why," said he, "I should be ashamed to make you the offer I should be obliged to, a man capable of earning the wages you can at your business. I have already two apprentices on that do not get $1 per day." Thinking a moment he continued: "I like your apparent straightforward honesty, and would make you an offer of $1.50 per day for six months, and if you got along as well as I think you would I would do better by you, but of course you would not think for a moment of accepting this offer." I told him that it would not be the first and surely not the worst sacrifice I had made to learn something, and would accept his offer and would be on hand ready to go to work the next Monday. I went out and was fortunate in finding a desirable tenement, with much land attached, at a rentage of $23 per year. So things were not looking so bad after all. And here ended my weaving life apparently for all time, but not my mill life by any means. I moved my family, now consisting of wife and three little girls, to Norfolk, and commenced a new career that better fitted me for the mill life that I have since followed. I was ready to start work the following Monday morning as per agreement. Mr. Munn started me on a lathe to turn up 150 12x1½-inch pulleys. These pulleys run in gangs of three and had to be quite accurate as to size and space between edges. I begged him to break me in on cleaning castings or something I would not be likely to spoil, but he said he could not pay $1.50 a day for cleaning castings. I told him to drive ahead, I would do the best I could on the lathe. He started me off after explaining all the points necessary, and here commenced my life as a machinist. Mr. Munn said but very little to me all the first week, never correcting or giving advice, but closely watching me. At the end of the first week, with a pair of calipers and straight edge, he tried each finished pulley piled at the end of the lathe. Rising to his feet he said: "I find your work perfect, and you have earned me more money this week than any man in the shop." Surely very encouraging for a new beginner. I got a hold of the different branches of the business quite rapidly, and the first month Mr. Munn paid me, instead of the $1.50 per day as agreed upon, $1.75 from the day of starting with him, and he raised my pay 25 cents each month until my wages amounted to $2.50. This contract was finished in about one year after I went with Mr. Munn, and he was engaged to go to New Brunswick and take charge of the knitting company's larger machine shop, building the same and other machinery for their great plant there. He took me with him, and I started in there for $2.87½ per day, but in a few weeks received $3, about the average of machinist wages at the time, though several in the shop were receiving more. You will see that after a very little more than one year in the machine shop I was earning the regular wages of a full-fledged machinist.

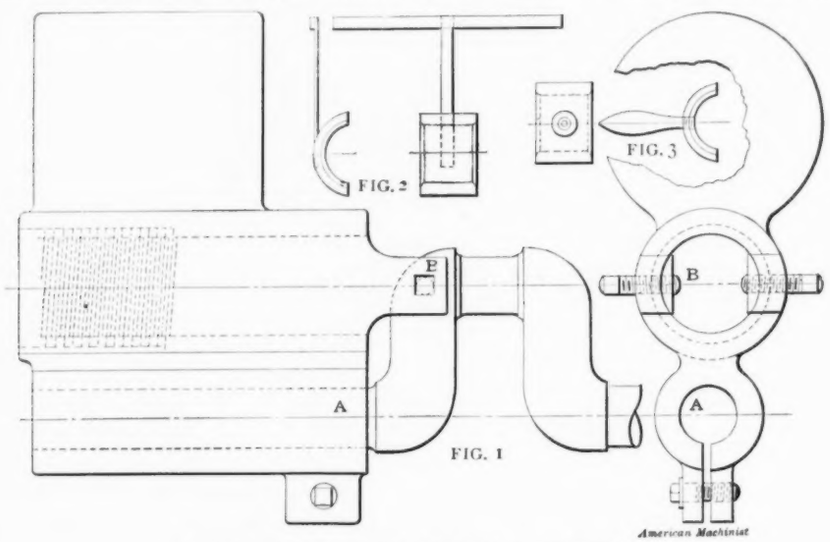
The Value and Application of Theoretical Knowledge.

At the January meeting of the New York Railroad Club an excellent paper was read by Mr. F. B. Bissell upon "Stresses and Strains in Axles and Wheels in Service." The paper went very thoroughly into the theory of the matter, and in the discussion of it which followed

Prof. H. Wade Hibbard spoke of the high value of technical calculations in practical work. We append a few of his words:

The recent designers of our steel cars have gone far more thoroughly into technical calculation of the strains on different parts than the designers of other types of railway machinery, and the work is being carried on into the locomotives. We don't want to be frightened at the thought of theoretical designing when we remember that the enormously high buildings of the present day have only been rendered possible by scientific cross-sections of eye-beams and their theoretical combinations. We know that material has been put into these structures in such a way as to bring forth its greatest strength according to the theoretical laws of mechanics, and these lofty buildings would not be constructed if their engineers had to use steel in the shape in which wooden beams and posts used to be made. I believe that one of the marked differences between American locomotives and European locomotives—and I have studied and compared them both in their native haunts—is to be found in the theoretical designing of the European locomotives. As one sees in an exposition a theoretically designed French connecting rod alongside of an injuriously massive and not so carefully designed American connecting rod with its extra counterbalancing, one is impressed with the desirability of just such treatment of all these subjects as is found here in this treatment of the axle.

We should use theory tempered by experience. If you design a locomotive rod and follow simply Wöhler's experiments as to the fiber stress that Mr. Bissell speaks of, you may design a rod too large or too small. If, however, you have information as to eye-beam connecting rods which have broken and as to other rods which have stood the strain, then you may make use of your formulas and determine the fiber stress of the rod which has stood and the fiber stress of the rod which has broken. You have then in your possession a limit above and a limit below, and you may introduce that fiber stress into your formula for designing a new parallel rod for a given engine and will be able to get a rod which is close to the proper scientific strength.



CHUCK AND GAGES FOR TURNING CRANK-PINS.

Gas Engine Tools and Fixtures—Turning Small Crankshafts.

BY LUCIEN I. YEOMANS AND CHAS. E. SIGLE.

For economically machining small, single-throw crankshafts different fixtures are required from those employed on heavier shafts having finished cheeks, the former lacking rigidity and bracing jacks being applicable.

The crankshaft of this class is usually bent up from rough round stock and finished only at its working points. High-speed steel in a rapid reduction lathe, with the help of the stiffening clamp shown in Fig. 5, answers very well to remove the stock, preliminary to grinding, from the parts intended for main journals and for the flywheels. The grinding is the final operation after the crank-pin is finished and the keyways are cut.

Turning the crank-pin is a different matter, and the fixture shown in Fig. 1 is a most satisfactory device for the purpose. It is made to screw on the spindle of a stiff, heavy lathe, and the counterbalance is of sufficient weight to balance the opposite side with the crankshaft in place. One end of the shaft being set in the hole at *A* and the crank arms centralized between the set-screws at *B*, it is clamped in position by tightening the several screws, and the eccentric revolving steady-rest, Fig. 6, is moved along the latheways on the free end of the shaft to a point as near the free crank arm as possible and clamped there. A stepped roughing tool of the form shown in Fig. 7 about 1-32 inch narrower than the width of the finished pin is fed down to nearly the required diameter, when it is replaced by a forming tool of the required finished width and correct radii at the corners, and the pin is finished.

The gages, Figs. 2 and 3, are used respectively for setting the tool central with the inner shoulders of the main shaft and for testing the width and corner radii of the crank-pin.

Milling keyways with V-block fixtures proves too slow in the case of these crankshafts, and milling jigs of the type shown in Fig. 4 are used in pairs for this purpose.

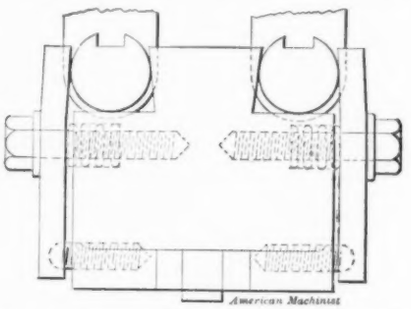
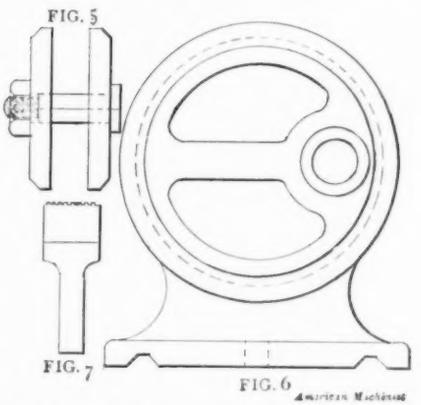


FIG. D. FIXTURE FOR PLANING CRANKSHAFT KEYSEATS.

The elevated central portion is planed at an oblique angle on the sides and the clamp faces are inclined the reverse way, so that one turn of the binding screws secures the work. This form of keyseating fixture also proves of great utility when used for work to be milled its entire length.

An English Shopman on American Shops and Workmen.

We find in a recent issue of *The Mechanical World* an interesting article on "American Shops and Men," from which we take some extracts. The writer evidently writes from personal knowledge and with all show of fairness. What he says must be understood of course to be addressed to an English audience whose special knowledge and habits of thought he recognizes. It seems to be evident also that his knowledge of American shops and workmen has been chiefly in the large cities, and that he knows little of the ways in the numerous smaller towns and the isolated plants which are distributed all



ECCENTRIC STEADY-REST, CLAMP AND TOOL FOR SMALL CRANKSHAFTS.

over the country, which limitation is to be regretted. In some respects the report might have been more favorable and in other respects perhaps less so if a more extended view could have been possible, but it would not thereby have lost in truth and interest.

The writer argues that our country is not what it has been to the immigrating workman, that America is falling back or remaining stationary and is being rapidly overtaken in the conditions of its working people. The workman here has harder conditions to contend with, he says, than the workman of Europe. He works harder and longer and gets less satisfaction out of his hours of leisure. When he is seeking a job he has to be more careful of his appearance than an English workman. We might question the assertion that "except, perhaps in politics, the American takes very little interest in anything outside of his work." The letter goes on:

"A return to England after a few years in America is very relaxing. One wonders comparatively what English workmen have to complain about. Why don't they do a reasonable amount of work during the few hours they are at it? Their pay is little enough, certainly, but it is not as well earned as the American's extra money. It makes one feel uneasy regarding England's future to see that the prevailing spirit is to give as little work as possible in return for wages paid. The writer quite understands the altruistic spirit which is largely the cause of it; but, looked at from an international standpoint, it is like one-sided free trade. You don't find it in American shops to any appreciable extent. The difference cannot be accounted for on the ground that the American is paid better, and treated better. The English workman, generally speaking, is treated as he wants to be treated, and has the conditions that suit him. Conditions that are entirely against his tastes cannot be imposed on him. Personally, I prefer English conditions to American—with the exception of wages, of course; but I should like to see English shops make for more freedom and equality between men on different lines from those prevailing in America, though in some respects America might well be followed.

"Comfortable working conditions is a thing we pay little attention to. The American works under the best conditions he can get. The majority of shops are kept at nearly the same temperature the year round. Ice water is generally provided for drinking, both in summer and winter, but that is to satisfy a taste which the British workman has never developed. The extreme heat and consequent perspiration in summer make frequent drinking necessary, and uncooled water gets too warm to be satisfying; and when a person has got accustomed to the taste of ice-cold water, water that has not been reduced to that temperature is distasteful. The American foreman is less of a superior officer, though usually this does not improve him as a man. Nevertheless, there is less constraint in his presence, and the greater amount of freedom tends to result in more work being accomplished. It is not considered lazy or effeminate to sit down to do anything which can be performed sitting. In many English shops men who work at benches are expected to stand always. This in most cases is no hardship, especially in the shorter English working day; but still, when a man can work as well by sitting, if he feels inclined, his day's work tires him less, and so better results no doubt are obtained.

"The working hours also are arranged in America for getting the most out of a day without extending it over a longer period than can be avoided. On the average the American mechanic works an hour a day more than the English; yet this hour extra doesn't actually lengthen the day. It is cut out of the meal times. The American starts work about an hour later and his day's work is finished about an hour later than the English. Actually, however, he has to turn out of bed at about the same time, because before he goes into the shop he must have a meal that will last him for about five hours. Then with about half an hour to eat another meal he has to go an even longer spell of generally five and a half hours. It takes the Britisher in America some time to get accustomed to this. Personally, owing no doubt to my early training, I never have been able to eat a heavy meal first thing of a morning. Not that the American eats a great deal, but he can get along very well on three meals a day, whether they are light or heavy. In fact, the free lunch which we often hear about can scarcely be called a meal at all, and yet thousands of workingmen find it sufficient to last them from breakfast to supper. These men, of course, are beer drinkers, and that makes a difference. They find it cheaper to pay five cents for a glass of beer, and so get free access to the biscuits, salt fish, sourkrout, pretzels, and other German dishes calculated to make one want more beer, than to pay 15 cents for a dinner at a restaurant. It must not be supposed, however, that the American workman is poorly fed. There is no country in the world where working people have better conditions in this respect. The quality and cooking here are often better, but we have not the variety, or it is not within the means of working people to get it. Judging by restaurant prices, food is a little dearer here. The 15-cent meal at an American working-class restaurant is more elaborate than could be got for 7½d. here. On the other hand, as I have said, the quality is generally inferior, and occasionally I have suspected the beef I was eating to be horse flesh."

The writer seems to have had more than his share of experience in American shops with "beats," borrowers and "suckers," for he speaks of them as numerous and irrepressible. We could locate individual specimens of each class, but would not know where to look for them except as thus isolated and infrequent. He mentions the now familiar fact of the general liberality of shop proprietors towards visitors of all classes. He finds men of English birth "predominant" in engineering establishments; there are, also, he says, many of other nations, but "the Irishman scarcely at all."

"A man who has learned his trade in Britain must expect when he enters an American shop to learn it to some extent over again. Where there is more than one possible way of doing a thing, the American practice is almost invariably different from the usual practice here. Occasionally it is a slight improvement on our method; usually it is a matter of opinion, and sometimes it seems decidedly inferior. Engineering, like many other things in America, is in a rather less matured state than here. Americans work less than us on past experience. They will attempt things which we should not attempt. Although protection may have been an advantage to them in some ways, it has undoubtedly restricted them in range of knowledge and experience. They have got men from Europe, but not much else. The result is that everything in America is American. There is not the variety that you find here. This want of competition with manufacturers of other countries not only prevents them from knowing what is being done abroad, but having only themselves to compete with, they are less embarrassed by commercial considerations. Nevertheless they turn out what the public wants, and except in the case of trusts, the public are well served. One noticeable feature of American work is the tendency to uniformity. All articles settle into one type without variety. What cannot be got at one place in that line, cannot be got anywhere else, unless specially ordered. This no doubt has been largely brought about by their commercial isolation. No doubt their patent laws have also contributed to it. It is analogous to our English peculiarity of expecting customers to adapt themselves to our goods. The difference between the two is that the American has a public of more uniform tastes, and he knows just what to supply them with, and if what he is manufacturing is not precisely what suits them, he ceases making it that way. The English manufacturer, on the other hand, more generally makes to order, or if he settles into a type, it can never be universally accepted, because other Englishmen will be making it differently, and the foreigner also will be in the market on equal terms.

"Besides learning his trade over again, the emigrant to America finds that the language that served him in England has to be considerably modified before he can

make himself intelligible in American shops. He has to learn the American names for the various tools and processes. The differences in this respect, however, are not so great as they seem to a stranger, who at first naturally notices differences only. Many of the words used are not really of American origin, but have merely gone out of use, or are only used in one locality in Britain. We have so many words in the English language that mean practically the same thing that it is no wonder some localities adopt one, and some another. Actually in America there is more uniformity in spoken language than here. There is less dialect. Dialect in the north of England and in Scotland is so pronounced that an English-speaking person not accustomed to it would find American much more intelligible.

"America, for the next century, at any rate, cannot fail in many respects to be the leading country of the world. Undoubtedly also they will be the most hated by other nations. Not necessarily because of their success, but because they prefer quarreling to peace, and in their dealings with foreign countries they will make no concessions of much value unless they are forced.

"Industrially, the outlook in America is worse than in any other manufacturing country in the world. The American character makes it so. Instead of improving, conditions are getting worse. Nowhere else are quarrels between capital and labor so bitter, and carried to such extremes. Nowhere else in bad times is there such an enormous number of unemployed. Nowhere else, except perhaps in Russia, are the police as barbarous and irresponsible. The lot of the extremely poor is probably harder in America than anywhere. The remarkable thing is that scarcely anyone in America believes these things. The impression that they are in the best and freest country in the world is ingrained in them. They credit themselves with practically all the advance the world has made during the last century in science and invention. However, they have enough unanticipated internal trouble of late years to occupy all their attention, and the future looks worse than the present."

The Patternmaker.

If ever you notice a self-made man
With the air of a Bursary taker,
And eyes that can pierce you through at a scan
And a voice like a frowsy Quaker—
Who carries a glaring excuse in each hand—
A straight-edge and section breaker,
Or a shrinkage rule and a blueprint plan—
That's the foreman patternmaker.

If still you're unable to focus him, mate,
He has other traits—and greater:
He is always willing to give and to take,
So long as he acts as dictator.
He's a very good judge of a foundry fake,
And a splendid procrastinator,
And finally he—now, make no mistake—
Is a shavings masticator.

When there's the slightest doubt of a size
His trammels'll quickly fix it.
If a casting is too much avoirdupois—
Take all sorts of care that you mix it,
Or else prepare for a thundering noise
Before the time for his exit:
It's no use blaming the "blankety" boys,
For he'll still talk, *ipse dixit*.

Whenever you feel the need of a friend,
Slip down and tell him what's what;
He'll advise you when you should cast upon end,
And also when you should not.
He'll show you the way to part a quick bend
That's fixed, like a dog on a rat;
But should you unbend to enlighten *him*, friend,
You'll get your answer pat.

His arrival here in the foundry yard
Is always the source of conjecture:
Will he ask for the core-box for that guard?
Or the frame of that sunbeam reflector?
If you notice him come with face set hard,
The "old man's" booked for a lecture;
If not, most likely he'll speak by the card,
And pass some remarks on the "fracture."

His methods of molding a job would hoodwink
Sherlock Holmes or a puzzle connector,
And a stranger might have good reason to think
He was Principal Casting Inspector.
He fossicks around with blue pencil and ink
Like a tentative bad debt collector—
But the foundrymen know him by—"Hover a blink,"
"Here's the foundry Mistake Corrector."

COLD SHOT.
Iron Molders' Journal.

An Experiment for an Eight-Hour Work-Day.

BY J. L. GARD.

Near the end of December, 1903, I submitted a proposition to my employees under the conditions of which we would adopt an eight-hour day on January 1, 1904, asking them to look it over carefully and to offer any suggestions they thought would apply. The principal conditions proposed were as follows: They were to receive the same pay as had previously been paid for nine hours. They were to use their best efforts to do all they possibly could in eight hours. If they failed to do a satisfactory day's work in eight hours I was to have the right to call for an additional hour any day a man's work fell below a reasonable standard. Any error caused by a workman's carelessness or thoughtlessness, he was to make good on his own time; he must do his work correctly according to drawings and directions, and take the resonsibility of its being correct. It was to be understood that should the new conditions prove unsatisfactory to either employer or employed, that we would return to the nine-hour day and the old conditions.

The proposition was accepted as outlined above. I then gave them this talk before we started work under the new conditions:

"It will be possible to do this only by each one using his best efforts to work *with* me. Do your work with your mind on it, and always thinking what you are doing, and asking yourself if you are doing it the best way. Use your brains; they will develop by use. Do not depend on your hands alone; they are useless to accomplish unless directed by brains. Intelligent effort is what counts. Your day is profitable to yourself and your employer, according to the work you do, and not to the time you get in.

"The hours being less I shall expect more work per hour. You must not waste any time. I shall expect you to work every minute of the day and to do your playing afterward.

"You see that you are to be responsible for the correctness of your work, and that if you spoil work, you lose the time that you put on it. I shall charge material against you only in extreme cases. You see I am willing to share with you the cost of any error within reason. It is better to avoid errors than to correct them. Therefore use all possible care as your work progresses; check each part carefully before attaching other pieces to it. Be careful, but do not waste time in being so. If you waste time, you will have it to make up before your day is done. I want you to have an eight-hour day, but each of us must do his part to make it possible. You must be fair and honorable with me, else what right have you to expect fair and honorable treatment? I likewise must treat you fairly and honorably if I want fair and honest treatment from you.

"Let us work together and make the eight-hour day a success. It is a step toward the promotion of our mutual welfare. Don't make it necessary to return to the old conditions."

I am now working under these conditions and, on the whole, I consider it an improvement; but it is so new that it is difficult to go into detail at this time. When a man is paid for doing work he is expected to do it right; if he does not, why should he be paid for it? If a man must guarantee his work, he should be paid for it. By reducing the hours he gets a raise per hour if his work is correct; if it isn't, he doesn't get the raise, because he must work time that he gets no pay for. He is offered more pay for more efficient service, but he must guarantee such service.

The best of men will commit errors. A man that never made a mistake never did anything. If a man knows that his errors are made at his own expense, he will make fewer of them. No man can be entirely free from them.

In the short time that I have worked under these conditions, the errors have decreased about 60 per cent., which goes to prove that most errors are caused by carelessness or thoughtlessness. We are improving on this, and I hope to get the errors very much less. It is the wastes that eat up business profits.

I have noticed that now when a man has an error to correct all the rest seem to be aware of it, and he doesn't feel as good about it as if he hadn't made it.

When a man knows that he must do a day's work in eight hours or he will have to work nine for that day, he has something to keep him up to his work. He is made to feel that he must be honest in his dealings if he expects honest treatment. The whole scheme is an appeal to his honor and manhood. Kindness has in the past and will in the future accomplish things that brute force dare not attempt.

I hope later on to contribute another article on this subject, telling some of the things that develop, questions that arise and how differences are adjusted, with

some instances of the difference in time on similar jobs, under the new method compared with the old. I trust this will interest enough of your readers to bring out the opinions of some others.

Foreign Markets for American Machinery.

Makers of American pumps, motors, windmills, etc., would do well to note the success which has attended the artificial irrigation of relatively small areas of land in New South Wales. There is an opening in that colony for pumping machinery, motors, and other power generators—such as, for example, windmills and steam, oil and hot-air machinery. It may perhaps be advisable to sell such goods through agents who understand how to put machinery together. There are firms in Sydney who sell such lines as mentioned above for British and other makers, and they would no doubt deal in new ones if good and cheap. It would, however, be desirable to send out a competent man to put up some sample machines to prove their efficiency. As regards heating apparatus, although the Australian winter is short, yet in some parts it is severe enough to render artificial heating necessary, especially in schools, churches and shops. At present the ordinary open fire-place is used, but it is very expensive in fuel, and is also ineffective. A manufacturer of heating apparatus would do a good trade if he went about it in an energetic way. It would be necessary to send out an expert on hot air and hot water, and open a warehouse, but in the end he would get the business. Your exporters of wire netting, iron rails, and gates and barbed wire should note that there is every indication of a heavy demand arising in New South Wales for these manufactures.

While our British exporters of machinery and general manufactures have been content with a 4 per cent. increase in their trade with Switzerland during the last seven years, American exporters have increased the value of their buiness with that state by 58 per cent.! The comparison is more remarkable when we consider that Switzerland is within two days' easy journey of London, and is about ten to fourteen days from New York. Your shippers now do an annual trade there of 12½ million dollars, and that is an indication of a greater business to follow. This is due partly to American firms doing business in a manner and on terms suited to the market. For instance, I know of a case where a British and an American firm were asked to quote prices for a large order. The British firm sent their usual catalog for the home market, while the American firm sent their French and German price-lists, with the result that the order was placed in the United States. One British firm of machine makers, however, recognizing the openings that exist there, sent a representative to reside in the country, and that firm has more than doubled its trade. Switzerland buys about 26 million francs ($5,200,000) worth of miscellaneous machinery a year, and 63 million francs ($12,600,000) worth of iron manufactures. Makers of dynamo-electric machines have a capital market in Switzerland, also dealers in domestic machinery, weaving machines, locomotives, and milling plants.

During the past two years a growing demand for oil presses has been noticeable in Russia. Hitherto the old-fashioned method of pressing the oil out by means of oak beams has been employed, but is now falling into disuse. Apart from oil presses there is a large demand throughout the Ural country for all kinds of simple, strong, and fairly cheap machines—such, for instance, as would be used in mills, bake houses, sugar refineries, distilleries, etc. It is to be hoped that the efforts of the American Consul at Warsaw—who recently applied to his government for permission to open a sample room for American goods in connection with the consulate—have been successful, as he was certain that such action would lead to a demand for many American manufactures which are at present but little known in that part of the Russian Empire. A sample room is now being organized by several Austrian exporters, to be located at Warsaw, and it is backed by official support. Our British makers of machinery still refuse, as a rule, to reduce the weight of their machines sent to Russia. It is absolutely necessary to cut down all unnecessary weight. One British firm, however, did do this and obtained an order in competition for a press for baling raw textile materials. They reduced weight by replacing heavy cast-iron parts by wrought steel, which reduced the cost of the press by the great saving effected in the carriage and duty.

An English firm of engineers have recently made some shipments of machines for use in sericulture in Persia—an expanding industry there. Some of the larger firms in the town of Resht now use what are called "four secs" of an Italian pattern for the purpose of killing the chrysalides in silk cocoons, and at the same time extracting the moisture from the latter. The cocoons being placed in a large circular iron tank which slowly revolves, hot air is forced in, and after some hours they are removed. There are seven of these tanks in Resht, and the motors employed to work them are of Sheffield make. These machines appear to have found their way to this part of the world simply on their own merits. The owners of the motors have stated that they found them cheaper and better than other machines offered of German and other makes and they were also shipped very promptly.

On a previous occasion I referred in this column to the opening that exists in Formosa for cane crushing machinery. The governor-general there is now actively urging and encouraging the introduction of such machinery; and consequently it is most probable that many small mills will be erected by native sugar manufacturers in the near future. The mills most likely to be required will be those with a capacity of turning out from 3 to 5 tons of sugar per day (12 hours). The Formosa sugar factory, which commenced to work at the end of 1901, was estimated to be able to turn out about 30 tons of sugar a day, or about 4,500 tons during a season of 150 working days, but up to date this estimate has not been fulfilled, the output last season being 1,190 tons. F. C. C.

London, England.

The Mechanical Engineers are Told About Big Guns.

The regular monthly meeting of the American Society of Mechanical Engineers which was held at the house of the society on the evening of February 23 was largely attended and was a gratifying success. Major Rogers Birnie, of the Ordnance Department of the Army, told of the manufacture and of the various details of the construction and manipulation of guns used for field service and for coast defense. It must be confessed that the first part of Major Birnie's address was a little bit tedious. It was excellent book matter, being a résumé of the various styles of guns, and they are many, which have been successively developed and tried and some of them adopted for longer or shorter periods; but the enumeration of dimensions and of the various particulars of each successive arm could scarcely have been remembered if it had been thought worth while to do so. The exhibition of lantern slides which followed was intensely interesting and instructive and held the audience until 11 o'clock. It should be remarked that the term "gun" has in the War Department a limited application. There are guns, howitzers and mortars. Guns are for precision firing and generally also for the longer ranges, with an elevation not exceeding 15 degrees. Howitzers may be elevated to 45 degrees and mortars to 70 degrees. The first slides presented were diagrams of the details of construction of the built-up guns and the running explanations which accompanied them were full of interest and of valuable information in the best form for establishing itself in the memory. Various styles of guns, howitzers and mortars were shown, also gun mounts, projectiles and ammunition. Then the guns were shown in action and also their effects upon targets in some of which the targets got the best of it and in others where they were sometimes penetrated and sometimes completely destroyed. Projectiles were shown in detail and in two or three instances there were shown assembled beside a sample projectile the numerous pieces into which a similar shell had exploded. Samples of powder of various kinds were shown, with the different shapes devised for controlling the rate of combustion, also fuses

(Concluded on page 303.)

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This is the last notice concerning the index to the volume for last year. It will be sent free to all who ask for it and give their full address. But it will not be kept in stock for those who neglect to ask for it now. Address either the New York or London office.

Fireproof Buildings in the Baltimore Fire.

The first reports of the Baltimore fire—due to daily papers and of the usual degree of accuracy of those papers—were to the effect that the modern fireproof buildings within the fire area suffered about as badly as the older buildings, one report saying that they "burned up as if they were made of *papier maché*.

Reports and illustrations of the results of the conflagration are now beginning to appear in those technical papers which are devoted to building construction, and these reports show how wildly wrong the daily press reports were. It must be remembered that the exposure of these buildings was many times as severe as would ordinarily be experienced, but, notwithstanding this, the manner in which they withstood the test is nothing less than remarkable. In many cases, but for the absence of windows and window frames, the buildings appear from the illustrations to be substantially intact, this condition being substantially that of the same buildings after the housesmiths and masons had finished their work but before the carpenters had begun to put up the trim.

This is all and, in view of the tremendous exposure, more than could have been expected. To expect that the fireproofing of the structural features of the buildings could prevent the wood trim from burning under such conditions would have been manifestly preposterous. The fact which stands out is that the protection of the iron work from the effects of heat was effective, and this under conditions which in many cases simply melted the brass chandeliers and other exposed metal work.

Perhaps the most striking single illustration of successful fire resisting construction is furnished by the small four-story Commercial and Farmers' National Bank Building, which was fireproofed so far as the first or banking floor was concerned, but was of combustible construction above this floor. The upper floors of this building were completely gutted and ruined—the walls only remaining—but half-tone views of the interior of the first floor show it to be substantially uninjured. While that can hardly be the case in fact, nevertheless, so far as the half-tones show, the banking floor appears to be ready for occupancy. Even the wall decorations show no impairment, and this in spite of the fact that this floor had a continuous row of windows on its long side.

Another notable case is that of the Continental Trust Building, which appears to have been surrounded by combustible buildings on three sides and of which Mr. D. H. Burnham reports after examination that the steel structure is "intact and as good as the day it was put up."

In this matter of fireproof construction, architects have of necessity worked largely in the dark. They have had little experience to guide them as to the efficiency of their methods, and that they have been so successful is remarkable. They will, of course, work in the dark no longer. The Baltimore fire has supplied experience for all future time and, effective as it has shown existing fireproof construction to be, it will no doubt mark an epoch in that class of building construction. Numberless uncertainties will be cleared up, the claims of rival constructions will be settled, the sufficiency of numerous expedients and the insufficiency of others will be determined and, in short, knowledge will take the place of opinion and judgment. Architects will hereafter work with a sure hand and confidence will take the place of uncertainty. To the legislator and the insurance companies the lessons will be equally plain. Building laws throughout the country will be placed upon a sure basis, and insurance rates will be intelligently graded to suit different grades of construction. It would of course be far too much to say that the lesson is worth its appalling cost, but the lesson is nevertheless of tremendous value. Still less can it be said that Baltimore's loss is in any sense the country's gain, for, through the action of insurance, the loss is distributed and made to a large degree common to all parts of the country, but that this appalling disaster will work a new era in building construction is nevertheless certain.

An Example of Business Ability.

"I," said a well-known engineer, "in my younger, less experienced and more confiding days took a job (I then called it accepting a position) as superintendent of a small, old, rich and run-down concern with the general understanding that I was to bring it up to modern standards, increase its productive efficiency and reduce the cost of the work. I was told that I would be 'backed up,' and in my innocence thought that all was plain sailing before me. There was the old fogy shop dominated by old fogy men and pursuing old fogy methods. I knew and had had experience with better methods and there was plenty of money to pay the cost of their installation. I started in, made a careful study of the production of a certain article that was a staple with them, satisfied myself, and thought I had the cold figures and proofs to convince 'the firm' that by the expenditure of $6,000 or so costs of production would be decreased sufficient to pay about 30 per cent. on the investment. The head of the firm said he would 'consider it.' He kept on considering it and he 'considered' other plans but showed no tendency to adopt any of them. Seeing I could make no

headway in that manner, I bethought me of the plan of making some improvement and some reduction in the cost of the work without entailing any outlay. Thus, I reasoned, I shall show this ambitious but probably overcautious firm that I really do know something of conducting manufacturing operations and shall thereby perhaps develop in them a sufficient amount of confidence in yours truly to allow me to spend for improved equipment a few of the dollars I shall have myself saved for them. The premium plan had not been invented; I introduced piece-work. In doing this my conscience was entirely clear. I knew that if the men drove those antediluvian tools at their best pace the men would still be having an easy time of it. I offered fair prices and in every case guaranteed the permanence of those prices so long as I remained 'super' and the methods of production were unchanged. The men were shy, but finally one and then others took hold and some of them were after a while earning nearly double their old wages. The junior member of the firm, who looked after pay-roll matters, began to squirm, but was without very much difficulty made to see that it was all right—that while the men made higher wages the work cost less than formerly and that orders could now be filled instead of being lost to competitors who could fill them more promptly. But after a time the head of the firm, the man who was frequently referred to in the local newspapers, as 'the distinguished citizen and able business man whose genius had built up and whose sound business ability had carried to success the great works of the A. B. Mfg. Co.' 'got onto' the fact that certain old codgers that had worked for him for many years and had been apparently satisfied to make $2.00 a day were now drawing nearly twice as much. His blood boiled at the absurdity of it. No amount of showing him that the work cost less than before would pacify him. With a dignity of mein intended to be profoundly impressive he informed me that in all the years they had been carrying on business they had never paid such wages. The men had been perfectly satisfied and would be now with the old rates. The production must be kept up; that was what I had been hired for, but these prices must immediately be reduced! Expostulation, citation of my promise to the men, attempts to show him that to break faith with them would be bad business as well as bad morals were of no avail; he was a business man of years' experience and he knew what men could be hired for. My engagement terminated."

"Now," said one who had listened to this nature story, "don't you think that if your persuasive powers had been equal to your managerial ability you could have brought the Old Man around? You know it often happens that the most difficult part of a shop 'super's' job is not in managing the men under him, but in managing the man over him. It was in this latter part of the job that you failed. Now, suppose you had consulted him beforehand about this matter, had shown him just what results you expected to get by it, don't you suppose that you could have secured his assent to it and thus gotten him committed and interested?"

"Well," was the reply, "you can judge of the probability of that when I tell you of another incident. There was a group of lathes working on a certain job all the time. I saw that the work done by this group could be done by a single, patented machine of special type at that time beginning to be widely advertised, and opened up correspondence with the makers of it. They sent a man who came and looked over the situation. He went home and in a few days there came a written proposition to this effect: 'We will put in one of our plane turret machines, will instruct one of your own men to operate it and allow it to be operated by him for six months before you pay us anything whatever. If at the end of this six months period the saving in the cost of the work has not been sufficient to pay for the machine and the tools, we will take it away at our cost. But if the saving has been sufficient for this you are to pay us $1,635 for the machine and tools.' The Old Man said such a price for that machine was outrageous, and he wouldn't pay it. And the proposition was turned down."

It had been our intention to comment upon this o'er true tale, but upon reflection we think that comment would be superfluous.

The McCormick Technical School.

We are in receipt of some circulars regarding a school for employees which is conducted by the McCormick branch of the International Harvester Company, of Chicago. The school is conducted through arrangements which have been made with the American School of Correspondence whereby all persons registered in the McCormick Technical School may follow the courses of the correspondence school, except in the subjects of architecture and civil engineering, at a cost of $25.00. Special classroom instruction will be provided for these students, to supplement the correspondence work, and to help the student to overcome difficulties which naturally arise in the course of his studies. A small charge for this special instruction is made by the School at the rate of $1.00 for twenty meetings. Men who are considering taking correspondence courses, or men who have abandoned them, are cordially invited to consider the advisability of accepting this opportunity for completing their education.

A special course in shop mechanics is also provided, of which the following is the very satisfactory schedule:

Geometrical problems.

Standard threads, screws, bolts and nuts.

Lead screw of the lathe; its use and how to figure gears for cutting all threads.

The index head on the milling machine. The use of the graduated screw.

The bevel protractor; its use. How to figure an angle. Standard tapers and how to turn them.

Fits.

Cutting tools. Angles of tools. How to compute the number of flutes in a reamer of milling cutter.

Gears; bevel gears, etc.

Steam engine indicator.

Simple arithmetical methods.

Averages. Ratio and proportion.

Plane angles and angular measurements.

Mensuration of areas.

Horse-power of machines.

Use and application of Prony brake.

For this course a fee of $2.00 is charged.

The Metric System Before Congress.

At the hearing of the House Committee on Coinage, Weights and Measures, held February 25, Mr. Jos. Wharton, president of the American Iron and Steel Association, made, in the name of his association, an official protest against the passage of the pending bill. Mr. Wharton's appearance was the outgrowth of a mail ballot of the members of the association, the result of which was a substantially unanimous vote against the bill.

A Semi-Centennial.

The house of P. & F. Corbin, manufacturers of builders' hardware, New Britain, Conn., celebrated its fiftieth anniversary in fine style on February 14, there being an elaborate banquet attended by the officers and the older employees of the company. A small quarto of more than a hundred pages, beautifully and lavishly illustrated and excellently printed, gives an interesting story of the growth of the business from its founding in 1854 to the present.

We Must Have Full Name and Address.

Again it seems to be necessary to remind our friends that no attention can be paid to any communication or inquiry unless the writer gives us his full name and address.

The Mechanical Engineers are Told About Big Guns.

(Continued from page 301.)

of different kinds now in use with the arrangements for timing them. The pictures gave a very complete idea of the vast field of modern ordnance, and none who saw them and who followed the explanations could have failed to be impressed with the immense and untiring industry in experiment, investigation and systematic record keeping which goes on in times of profoundest peace not less than in the days of war to keep our armament always at least abreast of the foremost nations of the world.

Some New Things.

BOLT CUTTER.

Fig. 1 shows a Morgan type bolt cutter, and Fig. 2 a sectional view and a plan of the die head with which it is equipped. The chasers will be seen at *a* in the latter engraving and the closing shell or sleeve at *b*; *c* is the ring controlled by hand lever,

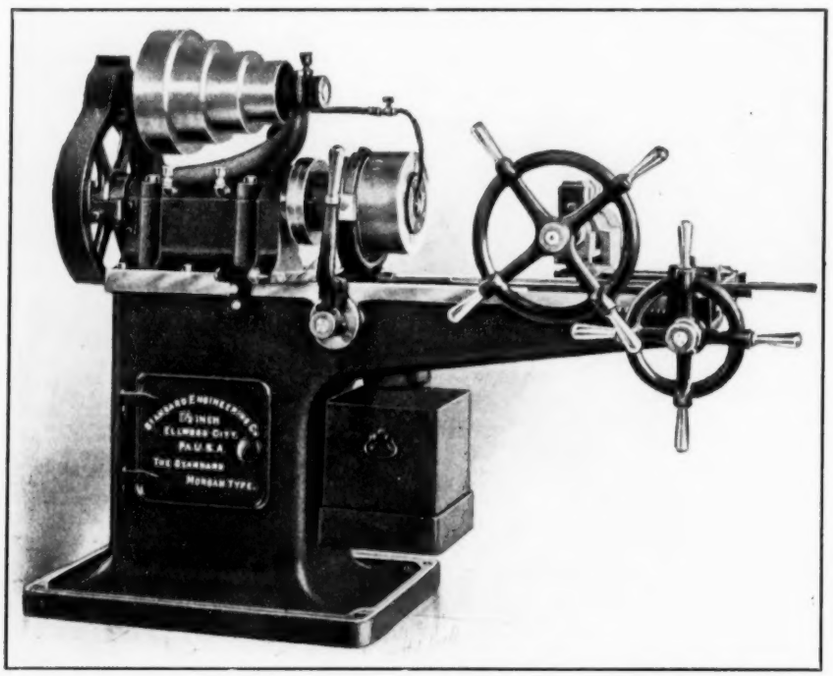


FIG. 1. BOLT CUTTER.

pinion and rack, or automatically through rod and trip from the carriage, for sliding *b* back and forth to open and close the chasers. The spring plunger *d* dropping into the notch in block *e* and lifted by the lever *f* when ring *c* is drawn back, limits the forward movement of the closing sleeve. To adjust the die to the desired size, the operator has only to turn screw *g*,

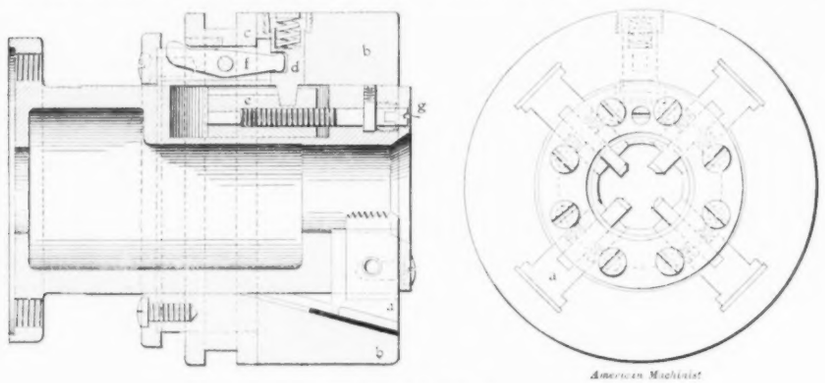


FIG. 2. DIE HEADS.

which, being confined longitudinally in the head, moves the plunger block *e* and sleeve *b* either forward or back as required. The principal features of design, such as outline of bed and head, the arrangement of driving gearing controlling levers, etc., are all clearly brought out in the half-tone. This machine is built by the Standard Engineering Company, Ellwood City, Pa.

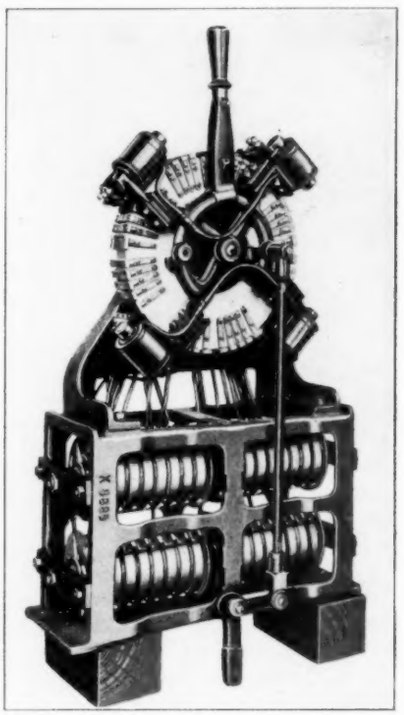
REGULATING AND REVERSING CONTROLLERS FOR ELECTRIC MOTORS.

The accompanying illustration shows a new design of controller which is intended more especially for crane and similar service and which is the product of the Westinghouse Electric & Manufacturing Company, and in the form shown is regularly made in capacities of 10 to 75 horsepowers.

The controlling mechanism is mounted upon a circular slab or base of insulating material, which provides high insulation between adjacent contacts and between the contacts and ground. The contacts are arranged in parallel rows around the periphery of the disk, the relative position of the contacts and the finger tips being the same as that of the brushes and commutator in a generator or motor, and both contacts and finger tips can be easily removed and renewed without disturbing the mechanism. The same contacts are used for application of the current in either direction, thus lessening the number required, while a magnetic blow-out makes it impossible to maintain an arc and prevents burning of the contacts.

Each controller has four brush holders mounted upon a rocker arm to which the handle is attached directly, without gears or pinions. A single movement to right or left applies or reverses the current, and the distance the handle is moved determines the motor speed by varying the amount of resistance in series with the motor armature. There are sixteen steps in each direction and a very close regulation of the speed is thus obtained. When the controller is placed in the rear of a crane cage, it is operated by a crank and lever directly attached to the spider which carries the brushes.

The resistance used with controllers of



COMMUTATOR TYPE CONTROLLER.

large capacity is of the grid type, while for small capacities with large ohmic resistance an improved cell resistance is employed with ventilating spaces between the cells, which are separated by non-combustible insulating spreading blocks. The resistance is varied for the different capacities and uses of the motor which the controller governs, a different resistance being used for crane controllers where a close regulation is required from that provided for roll tables and soaking pits where sudden and repeated starting and reversing are the prime requisites. It will be observed that all parts are exposed to view, and connections are easily made.

When the space available is such as to make the arrangement more convenient, the controlling mechanism is mounted upon the side instead of the top of the

frame containing the resistance, as shown, and for capacities less than 10 horse-power the face-plate type of controller is used, which, however, contains many of the main features of the larger sizes. Thus it has contacts and finger tips which are easily renewed without disturbing the connections; has a powerful magnetic blow-out, and in principle and manipulation is the same as the commutator type.

A LARGE MAGNETIC CHUCK.

The engravings illustrate a remarkable magnetic chuck recently made by O. S. Walker & Co., of Worcester, Mass. This chuck has a vertical work face 96 inches long by 12 inches high, is 18 inches in hight over all, and is used on a Norton 8-foot grinder equipped with special head, spindle and wheel to adapt it for face grinding.

The chuck body is made in one casting with rectangular magnetic gaps, and is fitted with three separate magnetic sections any one of which can be energized independently, if desired, as each section has its own switch. The work held by this chuck is ground under a copious supply of water and efficient guards are provided, as indicated, for chuck, wheel, and machine. In the line engraving *A* is the main casting or body; *B*, the magnetic face; *C*, one of the magnet cores about which is placed the coil. *D* represents a cover fastened over the coil chamber by screws, not shown; and *E* is an opening into the coil chamber which is tapped for one-inch pipe with hose connection through which air is blown into the chuck to keep the interior free from moisture. A similar opening is formed at the other end, and the air blown in at each end passes out through vent holes at the bottom of the coil chamber. At *F* is shown an angle support for heavy work which may be placed on the face of the chuck; this support can be moved out to any required distance from the face and clamped in any position. The guard *G*, fastened to the top of the chuck, is tapped at *H* for a nipple over which is slipped the rubber hose protecting the wires which enter at this point to the switches at the back. An oil cloth curtain attached to the back of the guard prevents any water which may splash from the latter from getting to the switches. A water-tight joint between guard and chuck is formed at *I*, a longitudinal groove being planed through the chuck top at this point for the insertion of rubber packing. The switch contact terminals *J*, through back plate *D*, are doweled to terminal strips on an insulating block inside the coil chamber, and to these strips are soldered the coil connections. As will be seen, the back plate may be removed from the chuck without disturbing any of the connections. At *K* and *L* are shown different poles of the magnetic face, *K* being formed integrally with one of the chuck cores *C*, and *L* being a section of the chuck body; each section *K* forms a magnetic pole of opposite polarity to each section *L*, the magnetic lines of course flowing across the gap between the two. With this construction it is apparent that

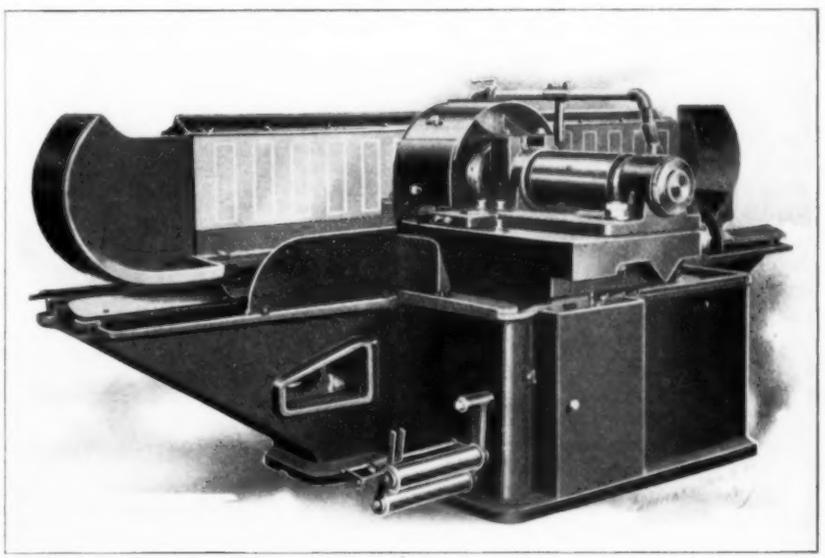


FIG. 1. A LARGE MAGNETIC CHUCK.

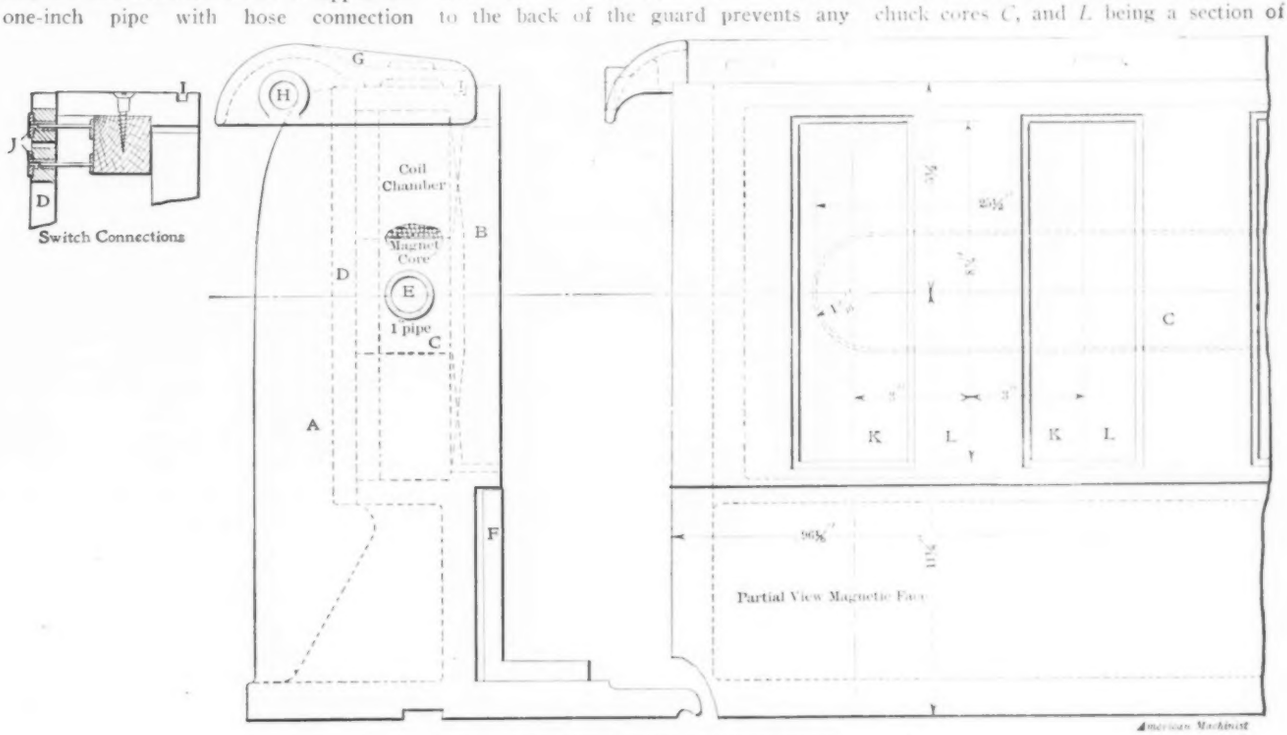


FIG. 2. SHOWING CONSTRUCTION OF CHUCK.

such chucks can be made of practically any size required.

The chuck illustrated is used for holding long knives of all kinds while these are being ground by a cup-shaped emery wheel. It is obvious that chucks of equal size can be constructed of the horizontal type; and either type can be wound for direct current of any voltage.

NEW ELEVATING GEAR FOR PLANER CROSS-RAIL.

The engravings illustrate a novel and interesting mechanism for raising and lowering by power a planer rail. The device is shown in place in the half-tone, Fig 1; Fig. 2 is a sectional view showing the detail arrangement, of which *a* is the pulley shaft, and *b* and *c* the driving pinions. *d* is a perforated bush driven into the driving pinions, which eliminates the counterbore necessary for the split clutch ring *e*, and also carries the oil for the bearing. At *f* is a steel sleeve which is secured to the pulley shaft with a taper pin and holds the friction rings in place endwise without additional washers or collars. It will be noticed that the ends of the sleeve are turned down so that each end fits loosely into a split ring, thus preventing the wedge rings from drawing out of the gears. This steel sleeve is splined its entire length, and the collar *g* has secured to it a key which slides in the spline and is tapered at each end to fit the taper opening in the wedge rings, and consequently expands either ring according to the direction in which it is forced by the lever.

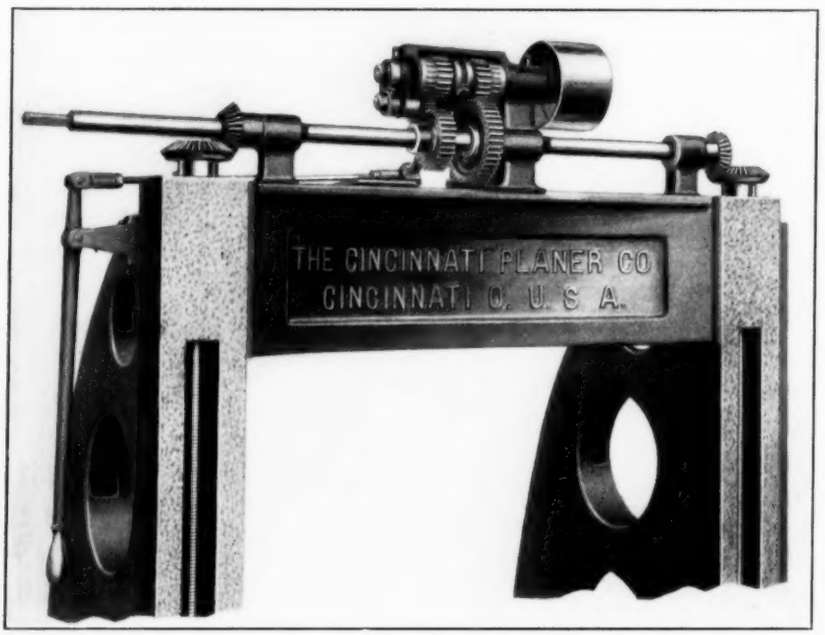


FIG. 1. POWER ELEVATING GEAR FOR PLANER RAIL.

The elevating gears are *b* and *h*; *c*, *i* and *j* are the lowering gears. As will be noticed, the raising gear *h* is much larger in diameter than the gear *j*; this gives a slower speed and plenty of power for raising the rail. The lowering gear gives one-third higher speed while letting down the rail, when there is practically no power required.

By referring to Fig 1 it will be seen that the device is so situated on the arch as to bring the large driving gear that raises the rail exactly in the center of the machine, so that if there should be any torsion on the elevating shaft, it will be distributed equally on each side. The bracket also provides for an additional bearing for the elevating shaft to take care of any spring or side thrust that may be caused by the gears. The long handle pivoted on the bracket at the side of the housing is within convenient reach of the operator and gives sufficient leverage for operating the taper counterwedges, so that the operator has full control of the movement of the rail, making it possible for him to raise or lower it to an exact point on the housing.

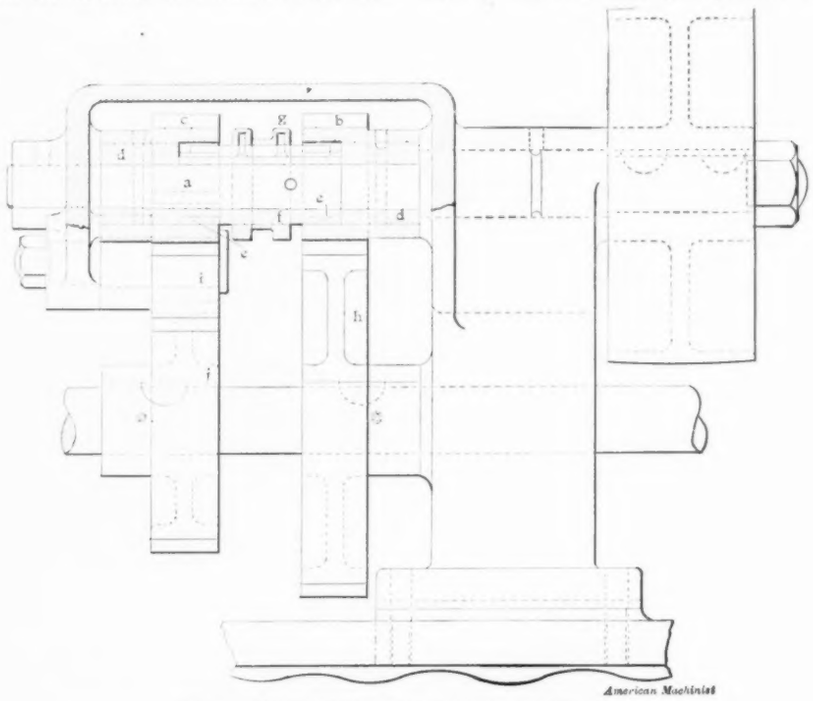


FIG. 2. POWER ELEVATING GEAR FOR PLANER RAIL.

By means of a locking screw in the bracket, the controlling handle is held in a fixed position while not in use. On the larger planers this locking device is brought down near the handle, so that it can be reached from the floor.

This elevating gear is the invention of George Langen, superintendent of the Cincinnati Planer Company, Cincinnati, Ohio, who are now putting the device on their entire line of planers.

We have received the first issue of *The Patternmaker*, edited by Henry A. Lane, and published by the Iron and Steel Press Company, Cleveland, Ohio. This first number is a very creditable one, and if succeeding issues are as good the journal should be all that patternmakers can expect. We wish it all possible success.

Personal.

Eugene A. Johnson, formerly with the tool department of the Pratt & Whitney Company, Hartford, Conn., is now superintendent of the machine shop of Geo. E. Lloyd & Co., 196 South Clinton street, Chicago.

Herbert W. Cole, who established the Star Drilling Machine Company, of Akron, Ohio, has organized the Crown Drilling Machine Company, of Akron, Ohio, for the manufacture of the Crown drilling machine.

A. N. Spencer, formerly second vice-

president of the J. A. Fay & Egan Company, Cincinnati, O., has resigned and goes with the American Machinery Company, Grand Rapids, Mich., as vice-president. Mr. Spencer retired from the Fay & Egan Company last November.

David Hunt, Jr., formerly with Manning, Maxwell & Moore, and recently treasurer of the Baush Machine Tool Company, has accepted the position of general sales manager for the Warner & Swasey Company, and will remove to Cleveland about March 15.

Obituary.

Charles F. Allen, treasurer of the Robert Bleakie Company's mills at Hyde Park, Mass., was killed, February 20, by the flywheel of the engine. He was alone in the room when the accident occurred.

James Parish Lee, of Hartford, Conn., well known as an inventor, and especially of the rifle which bore his name, died at South Beach, Conn., February 24, seventy-one years old. Mr. Lee was a native of Scotland.

Abraham Neafie died in Philadelphia, February 26. He was a brother of Jacob G. Neafie, the former head of the Neafie & Levy shipyards. Mr. Neafie was nearly eighty years old and had been employed in the yard almost fifty years, having been a machine shop foreman, retiring about a year ago.

William Wrigley died at Paterson, N. J., February 27, eighty-nine years old. Born in England he came to this country when ten years old, and at an early age began working in the Rogers Locomotive Works, where he became an expert machinist. In 1850 he had charge of a button mill, and a few years later he went into business for himself, first manufacturing links, chains and washers and later getting into a general machine business.

William E. Woodbridge died recently in the Garfield Hospital, Washington, D. C., eighty years old. He was an important contributor to the development of modern ordnance. He is said to have brought out the first rifle projectile for cannon ever fired. A claim for compensation for this service is now before Congress. Mr. Woodbridge devised and made the first wire-wound gun and was also a diligent student of the pressures developed by explosives.

Stephen Colvin, inventor of the Colvin loom, died at Riverpoint, R. I., February 18, eighty-three years old. Mr. Colvin learned the machinist trade and worked in two or three different shops on textile machinery. While working for Asa Sisson, builder of the Sisson loom, he developed a number of inventions which were embodied in the Colvin loom. After building a number of looms at Anthony, R. I., a company was formed and the Colvin Machine Shop was built at Riverpoint, where the business was carried on until a couple of years ago.

New Corporations.

Herrmann & Ulbricht Company, Brooklyn, N. Y.; biscuit machinery; capital, $5,000. Directors: Carl Herrmann, J. T. Ralphs, Brooklyn; C. W. Blake, East Orange, N. J.

Watson-Flagg Engineering Company, Paterson, N. J.; capital, $125,000. Incorporators: George H. Watson, John L. Flagg and Frank J. Huttin.

Newark Electrical Contracting & Manufacturing Company, Newark, N. J.: objects, manufacture electrical machinery, etc.; capital, $125,000. Incorporators: James Hodge, Adam Licht, Aug. Harth, all of Newark.

Vortex Electrical Fan Company—President and treasurer, H. F. Butler, Boston, Mass. Directors: As above and F. A. Hobbs, C. M. Hobbs, South Berwick, Me.; E. M. Sawyer, B. S. Nickerson, Boston, Mass.

Manufacturers.

The plant of the Albany (Ga.) Pine Products Company has been burned.

The Southern Metal & Hide Company is opening up business at Athens, Ga.

The Fremont, Neb., municipal electric light station will be enlarged by an addition, 30x60 feet.

The planing mill of Wm. H. George & Co., Rome, N. Y., has been burned, and will be rebuilt.

The Reading (Pa.) Iron Company will make room for extensive enlargements of its plant.

Helmers, Bettman & Co., shoe manufacturers, Cincinnati, O., are about to erect a large new building.

The management of the Roxboro (N. C.) Cotton Mills proposes to build an addition during the year.

The Meridian (Tex.) Citizens' Club is promoting a movement for building a cotton mill in that town.

The Birmingham (Ala.) Railway Light & Power Company will make extensive additions to its power-house.

Wadena (Minn.) will vote on the question of building a new power-house for the municipal lighting plant.

The Paul Whitin Manufacturing Company, of Northbridge, Mass., will build an addition for a weaving room.

It is stated at Marlboro, N. Y., that Lot Mackey is making arrangements to build a cup and crate factory.

The contract has been let for an addition to the plant of the Link-Belt Engineering Company, Nicetown, Pa.

The United States Malleable Iron Company, Toledo, O., is reported to have let contracts for a large foundry, etc.

The Portland Woolen Mills, located at Sellwood, a suburb of Portland, Ore., have been destroyed or badly damaged by fire.

Gaffney, S. C., capital is being invested in a cotton mill at Earl's, N. C. J. I. Sarratt and E. S. Thomason have purchased a site.

The Youngstown (O.) & Southern Railway Company has bought land as a site for a power-house, car barn, repair shops, etc.

Additions will be built to the factory of the Jas. Dunlap Carpet Company, at Fifty-sixth street and Lancaster avenue, Philadelphia.

The Tennessee Marble Company, recently incorporated, is opening up quarries at Concord, Tenn. A marble mill will be erected.

A new building will be erected for the plant of the Williams Stove Lining Company, Taunton, Mass., which recently was the scene of a fire.

Plans are being made for a power-house to be constructed for the Philadelphia Rapid Transit Company at No. 900 North Beach street.

The directors of the Brunswick (Me.) Electric Light & Power Company have voted to build an auxiliary plant to be driven by steam.

The officials of the Duncannon (Pa.) Iron Company have decided to rebuild at an early date departments of the rolling mill destroyed by fire.

The Canastota Knife Company, of Canastota, N. Y., has bought the factory at the corner of Court and Union streets, New Haven, Conn.

The Rotary File & Machine Company, Brooklyn, has removed to 589 Kent avenue, after a destructive fire at 429 Kent avenue, its former location.

The Citizens' League, of Cortland, O., has appointed a committee to select and purchase a site for the Warren, Cortland & Jefferson trolley line power-house.

The Schatz Manufacturing Company, of Mount Carmel, Conn., is about to move to Chappaqua, N. Y. The concern manufactures hardware and electrical goods.

It is rumored at Minneapolis, Minn., that the Twin City Railway Company may erect new car building and repair shops, but nothing authentic seems to be known.

According to a Newcastle, Pa., report, a new plant will be located at Ellwood, Pa., by the Copper & Brass Tube Company to manufacture copper and brass tubing.

The Fitchburg (Mass.) File Works have started the foundation for a $25,000 file factory. It will be of brick with a 100 horse-power engine and a 200 horse-power boiler.

The Bender-Martin Company, of 346 Broadway, New York city, builder of the Advergraph, is about to establish a plant for the manufacture of same in New York or vicinity.

The A. B. Farquhar Company, Ltd., agricultural implement manufacturer, York, Pa., has bought land for a new boiler shop, which will occasion enlargement of the machine shops also.

It is stated at Ionia, Mich., that Stafford Bros. are building a plant, for which woodworking machinery has been purchased. A 150x130-foot foundry is among the buildings being, or to be, erected.

The Brown Shoe Company, St. Louis, Mo., is to erect a four-story factory, occupying a lot 300x60 feet and costing about $70,000. It will have its own power and lighting plant, electric elevators, etc.

Congress has renewed the franchise held by the Keokuk (Ia.) & Hamilton (Ill.) Water Power Power Company to erect a power plant and build a wing dam on the Illinois side of the Mississippi near Hamilton.

A new five-story brew-house, three-story stock-house, one-story boiler-house, one-story wash-house and racking room and one-story cooper shop are being planned for the Northampton (Pa.) Brewing Company.

Representatives of an Indiana company have conferred with Anthony Bowen, secretary of the Board of Trade, Clarksburg, W. Va., regarding the proposed establishment of a large art and cathedral glass factory there.

A movement has been inaugurated to start a glass factory at El Paso, Tex. William Moeller is promoting the enterprise. The moral support of the Chamber of Commerce has been asked. It is proposed to organize the company at $20,000.

President W. H. Truesdale, of the Delaware, Lackawanna & Western Railroad Company, in his annual report for the year ending December 31, says: "It is planned to construct new and modern passenger car repair shops near Hoboken during the coming year."

Millice & Holcomb, proprietors of the Topeka (Kan.) Foundry, are forced to leave their present factory, as the property has been sold. The firm has received offers to go to towns in the oil region, but prefers to remain in Topeka if a satisfactory location can be found.

The Deer Creek Water & Power Company has been formed to construct a dam and light and power plant near Stewartstown, Pa. The directors have met in Stewartstown and elected president, James H. Gable, York; superintendent of construction, John K. Green, York.

The Elyria Engine Company, maker of gas engines, has recently increased its capital stock. A new plant to cost $100,000 will be built on the west side. The building proper will be 75x175 feet and will cost $35,000, the balance of the $100,000 to be used in the purchase of new machinery.

The plant of the Star Manufacturing Company, Wabash, Ind., has been sold to Barcus & Co., of Rensselaer, Ind. It is said to be the purpose of the purchasers to remove their establishment to Wabash, enlarge it, and push the patented article they have on the market, which we understand to be horse stocks.

The Hudson Structural Company has bought a site in Jersey City, N. J., for a factory. The company was incorporated August 10, 1903, with a capital of $125,000, by Alexander Morrison, Jr.; Harry and Jacob V. Clark, and will engage in the manufacture of structural and ornamental steel and iron.

A. W. Oberman, manager of the New Castle, Pa., stamping plant, is understood to have stated that a big glass plant is to be erected this summer at West Pittsburg by the Compagnie des Glaces et Verres Specials du Nord, of France. The company uses a new automatic blowing process and makes a specialty of large glass vats.

It is reported that the Tindle & Jackson Company, of Buffalo, N. Y., manufacturer of various products of hardwood, with mills at a number of points in Michigan, has purchased standing elm and basswood valued at $70,000, and will manufacture the same into barrel staves, heading and and veneering, at a plant to be erected at Munising, Mich.

The Falk Company, machinist, street railroad contractor and steel founder, Milwaukee, Wis., is understood to have secured 5½ acres of land adjoining the company's present plant in the Menomonee valley. The purchase was made for future enlargements of the plant. The company is at present erecting an addition to its machinery building of 125 feet, and other additions are contemplated.

A stemmery, with a capacity of 25 hogsheads a day, or 30,000 pounds of leaf, will be installed in Louisville, Ky., at a cost of $100,000 by the National Tobacco Stemming Machine Company, of Chicago. The object is not only to conduct a tobacco business, but to sell the new stemming machine throughout that section. The machinery to be put in the new stemmery will cost $62,500.

It is stated at San Diego, Cal., that Chairman C. W. French of the Board of Directors of the San Diego-Eastern Railway has acquired large iron interests in Mexican California, just to the south of San Diego County. His expressed purpose is to establish steel mills on the shores of San Diego Bay, and articles of incorporation of a company, capitalized at $10,000,000, are to be filed shortly.

It is reported at Springfield, O., as follows: "William N. Whiteley, the quondam reaper king, has secured the backing of McLaughlin, a well-known steel man, of Chicago, and will, it is said, at once erect shops in this city for the manufacture of agricultural implements. At the start 200 men are to be employed. Whiteley built the great East street shops here at a cost of about $4,000,000."

The Atlantic Machine Works, of Westminster, Md., have bought out the patents of the William H. Leister Manufacturing Company, of Baltimore, and established a machine shop at Westminster, primarily to manufacture the can labelers and shade roller labelers invented by W. H. Leister. The Atlantic Machine Works are incorporated with a capital stock of $15,000, and the officers are: E. Oliver Grimes, Jr., president; Wm. Hammond Leister, vice-president; Franklin M. Beggs, secretary, and Howard Schaeffer, treasurer.

It is reported that the Allis-Chalmers Company will expend $500,000 in enlarging its plant at West Allis, Wis., for the manufacture of electrical machinery, etc. Several new buildings will be erected to house the new department, and it is expected that the work will be finished by next fall. The Allis-Chalmers Company has recently widened its scope of manufacture and is now prepared to furnish steam turbines, hydraulic machinery, gas engines and electrical machinery, in addition to its line of engines and other machinery which is better known. It has become part of the Steam Turbine Advisory Syndicate of England, and manufactures the horizontal type of turbine known as the Parsons type in England, and also made by the Brown-Boverie Company, of Switzerland. It has become licensee for the hydraulic machinery of Escher-Wyss & Co., of Zurich, Switzerland, who furnished most of the turbines used at Niagara. The Allis-Chalmers Company, as is already known, is manufacturing the Nurnberg gas engine, for which it is the sole licensee for the Western hemisphere. All kinds of electrical apparatus will be made, and the executive officers of this department will include John F. Kelly, William Stanley and John H. Kelman.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

J. Gregory, 140 W. 23d st., New York, specialist in small machine designing.

Wire and sheet metal working machinery and tools. Emmons Collins, Chicago.

Wanted—Double action and dial feed presses. C. A. Bailey, Cromwell, Conn.

Write for sample copy, free, "Popular Mechanics," Journal Building, Chicago, Ill.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Patented specialties of merit. Address Power Specialty Co., Buffalo, N. Y.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—Specialties to make, either in metal or wood; best of work and prices. Sauls Brothers, Columbus, Ga.

Special machinery for reducing labor and increasing profits, designed and perfected. C. E. Sargent, M. E., 1214 Manhattan, Chicago.

Exceptional machine shop facilities; best mechanical ability; our rate 60c. per hour. Pollard-Alling Mfg. Co., 312 E. 23d st., N. Y.

Northern man in South Georgia wants partner in machine shop and foundry business, with some capital. P. O. Box 265, Quitman, Ga.

We will buy, pay royalty or manufacture for patentee a patent possessing merit; light machine work solicited at reasonable prices. Box 208, AMERICAN MACHINIST.

We desire an agent in every shop in the United States to handle our technical books; a wide-awake man can do very well; only one in a shop. The Derry-Collard Co., 256 Broadway, New York.

Information wanted for most economical method and machine to manufacture green or dry cores from 2½ to 4 in. diameter and from 2 to 7 feet length; willing to buy machine or designs. Address Box 203, AM. M.

Wanted—Hand screw machine or turret lathe, second hand, with capacity of about ⅞ in. round stock through wire feed. Address, giving present condition of machine and price, Edison Storage Battery Company, Orange, N. J.

Want to furnish men of proved ability, as managers, superintendents or foremen, in the metal-working industries; no charge; also want men to fill such positions. For terms address James Brady, Room J, 20th Floor, 220 Broadway, N. Y. City.

Wanted—Parties having light machine shop and wood-working equipment, to manufacture a good specialty; customers waiting; requires $1,500 to build first machine; detail drawings furnished by patentee; royalty contract or option. Box 201, AMERICAN MACHINIST.

We want to rent modern machine shop (not too large) in Greater New York, or within 15 miles, equipped with planers, shapers, lathes, millers, etc; light work; moderate rental; responsible parties; particulars required. Box 231, AMERICAN MACHINIST.

For Sale.

For Sale—Bundy time recorder; first class condition; 200 brass keys. E. G. F., care AMERICAN MACHINIST.

Boring and Turning Mill.—Second-hand 8 ft. boring and turning mill for sale at a bargain. For particulars address Chuse Engine & Manufacturing Co., Mattoon, Ill.

For Sale—Four complete sets of patterns with all drawings for large machine tools; will be pleased to correspond with parties wishing to take up a good line. Box 442, AMERICAN MACHINIST.

For Sale—First-class patented lathe tool for relieving milling cutters, with drawings and jigs for making same, and twenty finished tools and others partly finished. Address Box 210, AMERICAN MACHINIST.

For sale on favorable terms, the following Bath grinders: 2 No. 2 Water without strengthening knee and tray, 5 No. 2 Water with strengthening knee and tray (our latest type) and 1 No. 1 Dry. Parties interested correspond with Loop-Lock Machine Company, Waltham, Mass.

For Sale—A machine shop in New York city (Manhattan); suitable for special machine building, automobile and general repair work. Established three years. Fully equipped with modern tools, all in first-class shape. Good location. Address R. C. Handloser, M. E., 127 Duane st., New York.

The designer and owner of a machine that has proven its ability to turn out more and better work than any now on the market, wishes to place its manufacture in the hands of parties with sufficient capital and facilities to handle 15 ton weight of finished machine; expectations of personal return are reasonable; ready to be associated in the manufacture if desired. Box 161, AMER. MACHINIST.

For Sale or Rent—Factory building, well located, in a good manufacturing town of about 5,000; about 8,000 square feet floor space; equipped with 12 H.-P. new gasoline engine and line shafting complete; nicely arranged offices in connection; will rent for long term, or sell for part cash and take stock in good company for balance. For further particulars address P. O. Box 22, Shelby, O.

Manufacturing Plant for Sale.—We offer for sale, or lease if desired, the plant at the corner of 12th and French streets, which we are now vacating for our new works on the western city limits; equipped with power, cranes, tool foundations, shafting, hot air heating system, electric light plant, etc.; foundry in connection; suitable for medium or heavy manufacturing. Address Ball Engine Co., Erie, Pa.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this

heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Position as superintendent or assistant manager, by an energetic, progressive young man, with an up-to-date, practical and theoretical working knowledge of boiler and steel plate construction. Box 217, AM. M.

DELAWARE.

Mechanical engineer, age 28, technical graduate, 5 years' experience as designing draftsman and in charge of drafting room, will accept immediate engagement in operating, sales or drafting department; not particular about location. Box 173, AM. MACH.

ENGLAND.

Advertiser desires correspondence with a firm requiring the services of a works manager or superintendent; is at present engaged as such with electrical works in England; served one firm 8½ years in America in similar position; used to piece work; well educated; age 34 years. Apply Box 147, AMERICAN MACHINIST.

MASSACHUSETTS.

A draftsman, college graduate, 2 years shop, 5 years drafting room; experience in hydraulic and conveying machinery, elevators, presses. Box 232, AMER. MACHINIST.

Wanted—Position as superintendent or assistant, by A1 man; thoroughly experienced in modern shop practice; 15 years in present place. For further particulars address Box 218, AMERICAN MACHINIST.

Wanted—Position of responsibility, by young man; 13 years' shop and drafting-room experience; up to date on appliances for turning out work rapidly; understands handling men. Box 536, AMER. MACHINIST.

NEW JERSEY.

Foreman of machine department wants position; 20 years in machine shop; experienced in handling men; best of references. Box 214, AMERICAN MACHINIST.

NEW YORK.

Designer of Bliss automatic machinery, toggle drawing presses. Box 221, AM. M.

Machine designer, 10 years' practical experience, wants position. Box 220, AM. M.

Position as factory manager or superintendent; references. Box 224, AM. MACH.

Mechanical draftsman, with 4 years' experience, seeks position. Box 230, AM. M.

Mechanical draftsman, with 6 years' experience, desires position. Box 225, AM. M.

Shipping clerk, with several years' experience; accustomed to handling men. Box 226, AMERICAN MACHINIST.

Draftsman, Swede, mechanical, graduate, 4 years' experience, desires position. Address H., 231 Union st., Brooklyn, N. Y.

Draftsman, graduate, mechanical engineer, 25 years old, first-class man, is open for engagement. Box 219, AMER. MACHINIST.

Mechanical engineer, 7 years' practice in steam, hydraulic, heavy general machinery, desires responsible position with smaller concern. Box 207, AMERICAN MACHINIST.

Ad. Writer—First-class man, experienced in machinery advertising, seeks position, at good salary, with responsible company; references A1. Box 133, AMERICAN MACHINIST.

Reliable party wishes position as salesman, to represent a responsible machine and tool house in this vicinity; full knowledge of modern machinery and tools. Box 216, AM. M.

By a young man, position with manufacturing establishment, electrical or mechanical; opportunity for advancement considered in preference to salary. Address Box 227, AMERICAN MACHINIST.

By technical graduate, 6½ years' experience in design of engines, pumps and heavy machinery, also boiler and furnace construction and in managing business and selling; accustomed to responsibility and handling men. Box 215, AMERICAN MACHINIST.

Experienced business man wants responsible position as office manager, right-hand man, assistant to proprietor or high official; knows machinery business; best references. Box 223, AMERICAN MACHINIST.

Superintendent or assistant; am a practical toolmaker, and my business is manufacturing; I seek a position where ability and detail of management will tell; have been in charge either as superintendent or foreman for the past 9 years. Box 205, AMER. MACHINIST.

A well-known manager desires position; has had wide mechanical and selling experience in heavy machinery; strong, energetic, honest and possesses good executive ability; position paying less than $3,600 per year not considered. Address "Reliable," care AM. M.

A gentleman with broad mechanical and electrical experience and good technical education, about to locate in London, desires to represent machine tool or electrical concern in the United Kingdom; references furnished; best of connections; salary or commission. Address "Business," care AMER. MACHINIST.

Mechanical engineer; 18 years in responsible positions with government and private concerns, manufacturing latest and best guns, automatic and quick firing, rifle caliber to largest made; gun carriages, ammunition, torpedos, etc., in most modern manner, with most up-to-date appliances; competent to take full charge; willing to assist; correspondence solicited. Box 213, AMERICAN MACHINIST.

OHIO.

Designing draftsman, expert on Corliss engines, familiar with pumping and blowing engines, general machinery and power plant equipment, years of experience and up to date, is open for engagement. Box 204, A. M.

Wanted—Position as superintendent or chief draftsman, by a practical mechanical engineer; 32; technical education; experienced in simple and compound engines and general engineering. Address Box 229, A. M.

PENNSYLVANIA.

Position as manager of machine shop or foundry; experienced in buying and selling as well as general office work and detail shop management with satisfactory cost system; have large acquaintance in all sections of the United States; age 37. Box 139, AM. M.

VERMONT.

Machinist; temperate; 7 years, job shop, steam engines, boilers, pumps, gas engines; South preferred; references. Address Box 197, AMERICAN MACHINIST.

VIRGINIA.

Position wanted as bookkeeper or cost clerk in engine work; experience in both; good references. Address Box 228, AM. M.

WISCONSIN.

Sheet metal machinery, presses, punches, shears, hammer; designer with 7 years' experience in this line, now head draftsman, technical graduate, desires change. Box 206, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Several first-class machinists and toolmakers; good wages paid the right men; apply at once. Ross Rifle Co., Quebec, Canada.

ILLINOIS.

We are constantly increasing the scope of our work and invite applications for positions from first-class patternmakers, molders and core-makers; we always have vacancies. Address Allis-Chalmers Co., New York Life Bldg., Chicago.

Wanted—A man, about 32 years old, familiar with factory accounting in all details, by a large manufacturing concern a short distance west of Chicago; in answering state references, experience and salary desired; this is a good opportunity for the right man. Box 182, AMERICAN MACHINIST.

INDIANA.

Wanted—Experienced foreman for machine shop to manufacture automobile gasoline engines; good wages with advance; will give interest in business, which is well established. Box 222, AMERICAN MACHINIST.

MASSACHUSETTS.

Wanted—Reliable draftsman to make working drawings; state experience. Crompton-Thayer Loom Co., Worcester, Mass.

NEW YORK.

Wanted—A first-class toolmaker and all-around machinist. Write, giving experience, etc., McEwen Bros., Wellsville, N. Y.

Superintendency or general foremanship wanted; thoroughly experienced in shop practice, steam and electrical engineering. Box 212, AMERICAN MACHINIST.

Wanted—Experienced salesman to take a specialty being introduced to machine shops and other manufactories; may be taken as a side line. Address Box 211, AMER. MACH.

Wanted—Mechanical draftsmen, experienced in shop practice and designing special machinery; none others need apply; state experience; good positions for the right men. Address A-961, care AMERICAN MACHINIST.

Active, intelligent young man, who has worked in a machine shop, to sell an article of merit; one with some selling experience preferred; state age, experience and salary expected. Box 233, AMERICAN MACHINIST.

Wanted—Competent engineer, capable of taking complete charge of buildings and power plant of large manufacturing company in vicinity of New York city; state experience and references. Address M. S., care AM. M.

Wanted—Two first-class mechanical draftsmen, who have had charge of work in drawing rooms, as "engine men," on large steam engine work; steady employment to the right men; married men preferred. Address application to P. O. Drawer 953, Buffalo, N. Y., stating salary expected.

Wanted—By a manufacturer of steam pumps in Greater New York, a first-class draftsman, thoroughly familiar with the design and construction of triplex power pumps of modern construction, electrically driven and otherwise; in answering give full particulars as to age, experience, where and with whom, and salary. Address "Thorough," care AMERICAN MACHINIST.

OHIO.

General foreman, experienced in building high-grade machine tools; state age and salary expected, with references. Box 209, AMERICAN MACHINIST.

Wanted—Draftsman and designer on a general line of sheet, stamping and bar metal working machinery and tools; excellent opportunity; permanent position to right party; do not apply unless thoroughly competent. Box 180, AMERICAN MACHINIST.

PENNSYLVANIA.

Wanted—A man familiar with tool dressing and the hardening and tempering of steel tools. Box 199, AMER. MACHINIST.

First-class, experienced, mechanical draftsmen wanted at once by an old-established, large concern; those familiar with steam or gas engine design and with shop experience preferred. Apply by letter to "Chief Draftsman," care AMERICAN MACHINIST, stating experience in full and giving reference.

Wanted at Once—A foundry foreman and a foreman for machine shop; both must have some capital and be up to date in their lines, able to handle men to best advantage and turn out work quickly and right; must be sober, reliable and hustlers; a splendid opportunity to the right men. Address R. F., care AMERICAN MACHINIST.

Wanted—Mechanical engineer possessing thorough shop practice, to assume entire control mechanical departments, foundry and machine shops employing 150 men, engaged on repairs of Corliss and automatic engines, pumps and general mill and factory work; must be thoroughly up theoretically and practically; exceedingly desirable position for proper party; one who can invest a few thousand dollars preferred; address, with references, age, etc.; investigation will be thorough, and same is courted. Address "Keystone," care AMERICAN MACHINIST.

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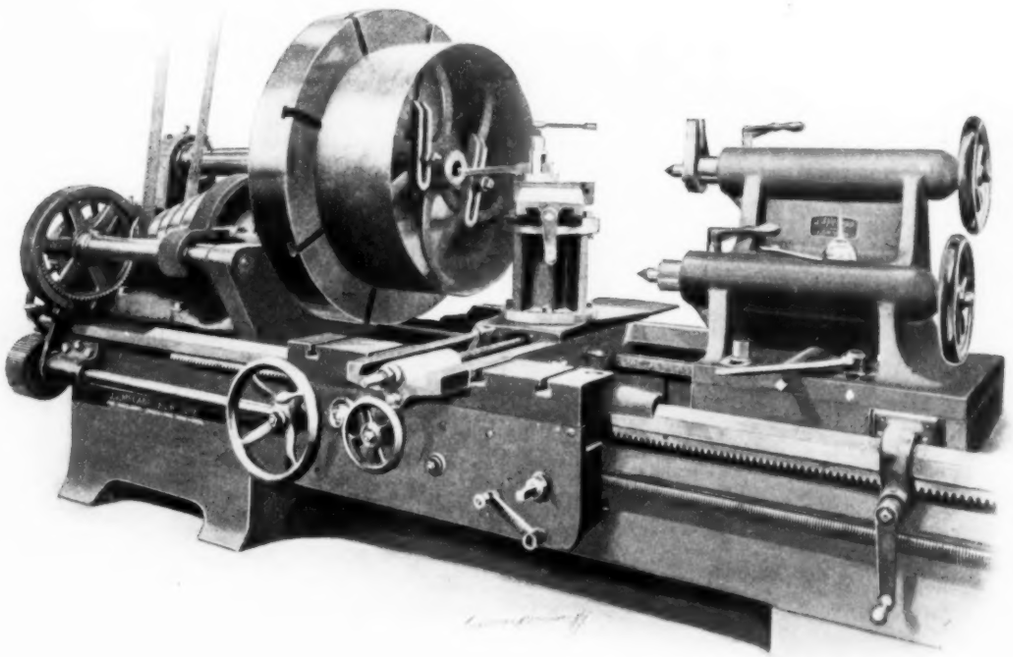

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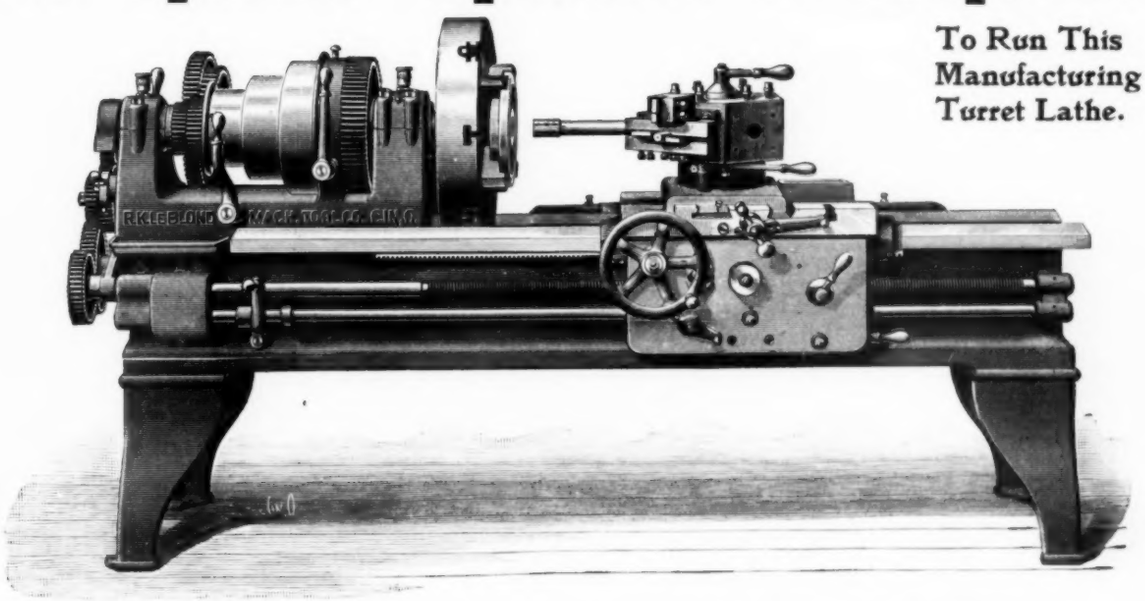

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Cushman Elec. Co., Concord, N. H.
Eck Dynamo & Motor Works, Belleville, N. J.
Emerson Elec. Mfg. Co., St. Louis, Mo.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Keystone Electric Co., Erie, Pa.
Mechanical Appliance Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrical Supplies

Akron Elec. Mfg. Co., Akron, O.
Bullock Elec. Mfg. Co., Cincin., O.
Clark, Jr., & Co., Jas., Louisville, Ky.
Commercial Electric Co., Indianapolis, Ind.
Cushman Elec. Co., Concord, N. H.
Emerson Elec. Mfg. Co., St. Louis, Mo.
General Elec. Co., New York.
Keystone Electric Co., Erie, Pa.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrically Driven Tools

Clark, Jr., & Co., Jas., Louisville, Ky.

Elevators

Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Emery Wheel Dressers

Desmond-Stephan Mfg. Co., Urbana, O.
Dickinson, Thos. L., New York.

Emery Wheels

See Grinding Wheels.

Enclosures, Tool-room

Merritt & Co., Philadelphia, Pa.

Engineer, Consulting and Mechanical

Hollingsworth, Saml., Plainfield, N. J.
McGeorge & Sons, Cleveland, O.

Engines, Automobile

Olds Motor Works, Lansing, Mich.

Engines, Steam

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers-Wells Co., Warren, Pa.
Sturtevant Co., B. F., Boston, Mass.

Engines, Gas and Gasoline

Bay State Gas Engine Co., Boston, Mass.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Struthers-Wells Co., Warren, Pa.

Engraving Machines

Gorton Mach. Co., Geo., Racine, Wis.
Roovers Mfg. Co., New York.

Exhaust Heads

Burt Mfg. Co., Akron, O.

Exhibition, Machinery

Philadelphia Bourse, Phila., Pa.

Fans, Electric

Emerson Elec. Mfg. Co., St. Louis, Mo.
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Fans, Exhaust

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Boston, Mass.

Files and Rasps

Barnett Co., G. & H., Phila., Pa.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Filing Machines

Cochrane-Bly Mach. Co., Rochester, N. Y.
Kinsey-Burt Co., New York.

Fillers, Oil Can

The Winkley Co., Hartford, Conn.

Filters, Oil

Burt Mfg. Co., Akron, O.

Flexible Shafts

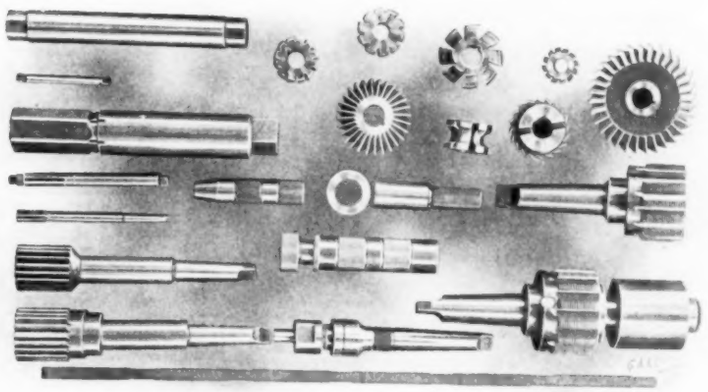
Chicago Flexible Shaft Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N. Y.

Forges

Boynton & Plummer, Worcester, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.
Sturtevant Co., B. F., Boston, Mass.

Forgings, Drop

Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.



Examples of Work Ground on No. 2 Machine.

It's On Work Of This Kind That The No. 2 Universal Landis Grinder Is Most Profitably Used.

This machine is adapted to grinding spindles, shafts, cones, sides of saws and plates; all work carried by a chuck or full plate, internal or external; and a large variety of parts such as are necessary to finish in a machine shop or tool room.

While this machine is used principally for tool room service, it is also very desirable for manufacturing small parts. As is characteristic of all Landis Grinders, its design and building are such as to secure the most excellent work, both as to finish and accuracy. Let us send you interesting particulars.

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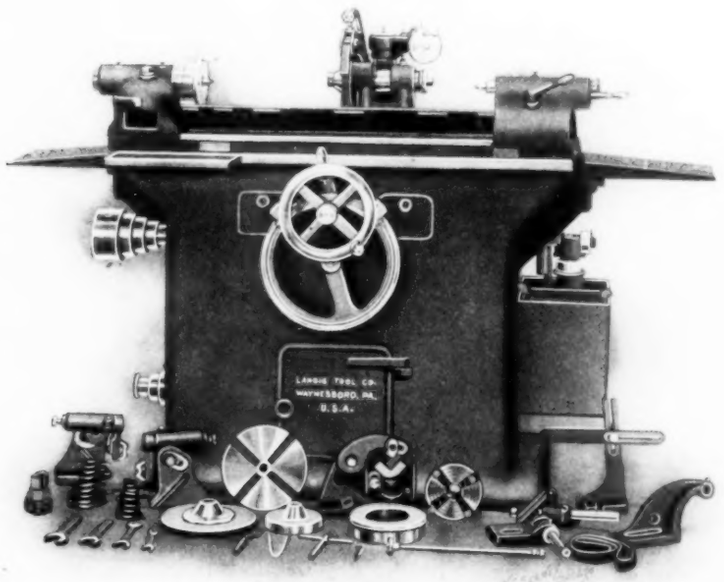


No. 2 Universal Landis Grinder.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Hay-Budden Mfg. Co., Brooklyn, N. Y.
Heppenstall Forge & Knife Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Byram & Co., Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Philadel., Pa.
Smith Fdry. Supply Co., J. D., Cleveland, O.

Furnaces, Coal and Oil
Buffalo Forge Co., Buffalo, N. Y.
Obermayer Co., S., Cincinnati, O.

Furnaces, Gas
Am. Gas Furnace Co., N. Y. City.
Chicago Flexible Shaft Co., Chicago, Ill.
Westmacott Co., J. M., Providence, R. I.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gear Cutting Machinery
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bultman & Co., F. H., Cleveland, Ohio.
Clough, R. M., Tolland, Conn.
Dwight Slate Mach. Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Geo. D. Walcott & Son, Jackson, Mich.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bultman & Co., F. H., Cleveland, Ohio.
Caldwell & Son Co., H. W., Chicago, Ill.
Cleveland Gear Works, Cleve., O.
Earle Gear & Mach. Co., Philadelphia, Pa.
Fawcus Mch. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott Co., The, Cleveland, O.
Messmer Mfg. Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Sawyer Gear Wks., Cleveland, O.
Simonds Mfg. Co., Pittsburgh, Pa.
Walcott & Son, Geo. D., Jackson, Mich.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.

Gears, Rawhide
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Earle Gear & Mch. Co., Phila., Pa.
Fawcus Machine Co., Pittsburgh, Pa.
Gould & Eberhardt, Newark, N. J.
Horsburgh & Scott Co., Cleveland, Ohio.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mch. Co., Pittsburgh, Pa.
Gould & Eberhardt, Newark, N. J.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Lubriphite Co., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald Mch. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.
Woodward & Rogers Co., Hartford, Conn.

Grinders, Disk
Besly & Co., Chas. H., Chicago, Ill.
Diamond Mach. Co., Provi., R. I.
Iroquois Mach. Co., New York.
Ney, R. W., Pine Plains, N. Y.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Heald Mch. Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Provi., R. I.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Valley City Mach. Wks., Grand Rapids, Mich.
Webster & Perks Tool Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding and Polishing Machines
Besly & Co., Chas. H., Chicago, Ill.
Blount & Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Fairbanks Co., New York.
Falkenau-Sinclair Co., Phila., Pa.
Goodell-Pratt Co., Greenfield, Mass.

Grinding and Polishing Machines—*Continued*
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Iroquois Mach. Co., New York.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mechanical Appliance Co., Milwaukee, Wis.
New England Mach. Co., Pawtucket, R. I.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Norton Grinding Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Standard Tool Co., Cleveland, O.
Valley City Mach. Wks., Grand Rapids, Mich.
Vandyck Co., J. R., New York.
Vitrified Wheel Co., Westfield, Mass.
Walker Co., O. S., Worcester, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.
Woodward & Rogers Co., Hartford, Conn.

Grinding Wheels
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Prov., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.
Whitney Mfg. Co., Hartford, Ct.

Grindstones and Frames
Athol Mach. Co., Athol, Mass.
Cleveland Stone Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

Gun Barrel Machinery
Diamond Mach. Co., Prov., R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Atkins Co., E. C., Indianapolis, Ind.
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Starrett Co., L. S., Athol, Mass.
Thompson, Son & Co., Henry G., New Haven, Conn.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Atkins Co., E. C., Indianapolis, Ind.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Fairbanks Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
Niles-Bement-Pond Co., New York.
Thompson, Son & Co., Henry G., New Haven, Conn.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Gould & Eberhardt, Newark, N. J.
Merrill Bros., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Drop—*Continued*
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., So. Boston, Mass.
Williams, White & Co., Moline, Ill.

Hammers, Pneumatic
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett Co., Thos. H., Phila., Pa.
Ingersoll-Sergeant Drill Co., New York.
Niles-Bement-Pond Co., New York.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

Hammers, Power
Niles-Bement-Pond Co., New York.
Scranton & Co., The, New Haven, Conn.

Hammers, Steam
Bell Engineering Works, David, Buffalo, N. Y.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.

Hangers, Shafting
Standard Pressed Steel Co., Philadelphia, Pa.

Heating and Ventilating Apparatus
American Blower Co., Detroit,
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Boston, Mass.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Browning Engineering Co., Cleveland, O.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Cleveland Crane & Car Co., Wickliffe, Ohio.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Sprague Electric Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, New York.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Rue Mfg. Co., Philadelphia, Pa.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Insurance, Boiler
Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

Iron Filler
Felton, Sibley & Co., Phila., Pa.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Jacks, Screw
Norton, A. O., Boston, Mass.

The Timmis Lithotype—II.

The second, or transfer printing, machine is shown in Fig. 5, the type cylinder having already been shown in Fig. 1, but appearing again in position in Fig. 5. At the left in Fig. 5 is a roll of the perforated paper strip from the composing machine, and leaving the type cylinder is a strip of paper, to which the machine has translated in printed characters the matter contained on the perforated strip.

The impression point is always the same whatever may be the character which is being printed, or, in other words, the movement to bring the proper type to the impression point is a movement of the type cylinder both axially and circumferentially. On the other hand, the movements for spacing between lines and between letters and words are made by the paper. All of these movements are determined by the electrical contact pins, shown in Fig. 5, which stand in a row above the paper, and which by dropping through the holes in the paper make electrical connections which determine the movements. The method of determining the movement of the type cylinder will be explained presently, but meanwhile it should be observed that the types occupy but one-half of the surface of the cylinder, the opposite side being occupied by a series of holes, one of which is diametrically opposite each of the types. After a type has been moved to the impression point, a registering pin enters its hole and thus positively locates the type in the correct position.

In the present machine the perforated strip is fed in backwards, the machine beginning its work with the last letter of the last line and proceeding from this backwards to the beginning. The holes in the punched strip, which determine the justifying of a line, are of course the last holes punched for that line, but the paper being fed through the second machine backward, these holes give their signals at the beginning of work on that line, and the machine is thus adjusted for each line, as regards justification, before any type impressions are made. This will be changed in future machines, in which the paper will be fed forward, but our description will of course be confined to the machine shown.

Taking up now the movements of the type cylinder, they are accomplished by a pair of cams and two sets of stops. The cams are mounted upon a revolving shaft in the rear of and slightly below the type cylinder in Fig. 5, and the two sets of stops are shown respectively at *a* and *b*, Fig. 6. After each character is printed, the cams throw the cylinder to its extreme positions both axially and circumferentially, when it is released by the cams and springs return it to the stops. The punched paper traveling below the row of contact needles seen at the left in Fig. 5, two of the latter pass through the holes, and, making electrical connection, throw up one each of the stop pins *a* and *b*, Fig. 6. The former of these determines the point at which the cylinder shall stop on its return axially by the spring, and the latter, engaging with one of the spirally disposed stops *c* upon the axis of the cylinder, determines the point at which the cylinder shall stop on its return circumferential movement, after which a pin *d* enters the registry hole of the type cylinder which faces it and locks the cylinder in position for printing.

The stops *a* perform also the functions of determining the spacing between letters and between words as far as the unitary spacing is concerned, while the stops *b* attend to the tenths divisions. These double functions are possible because of

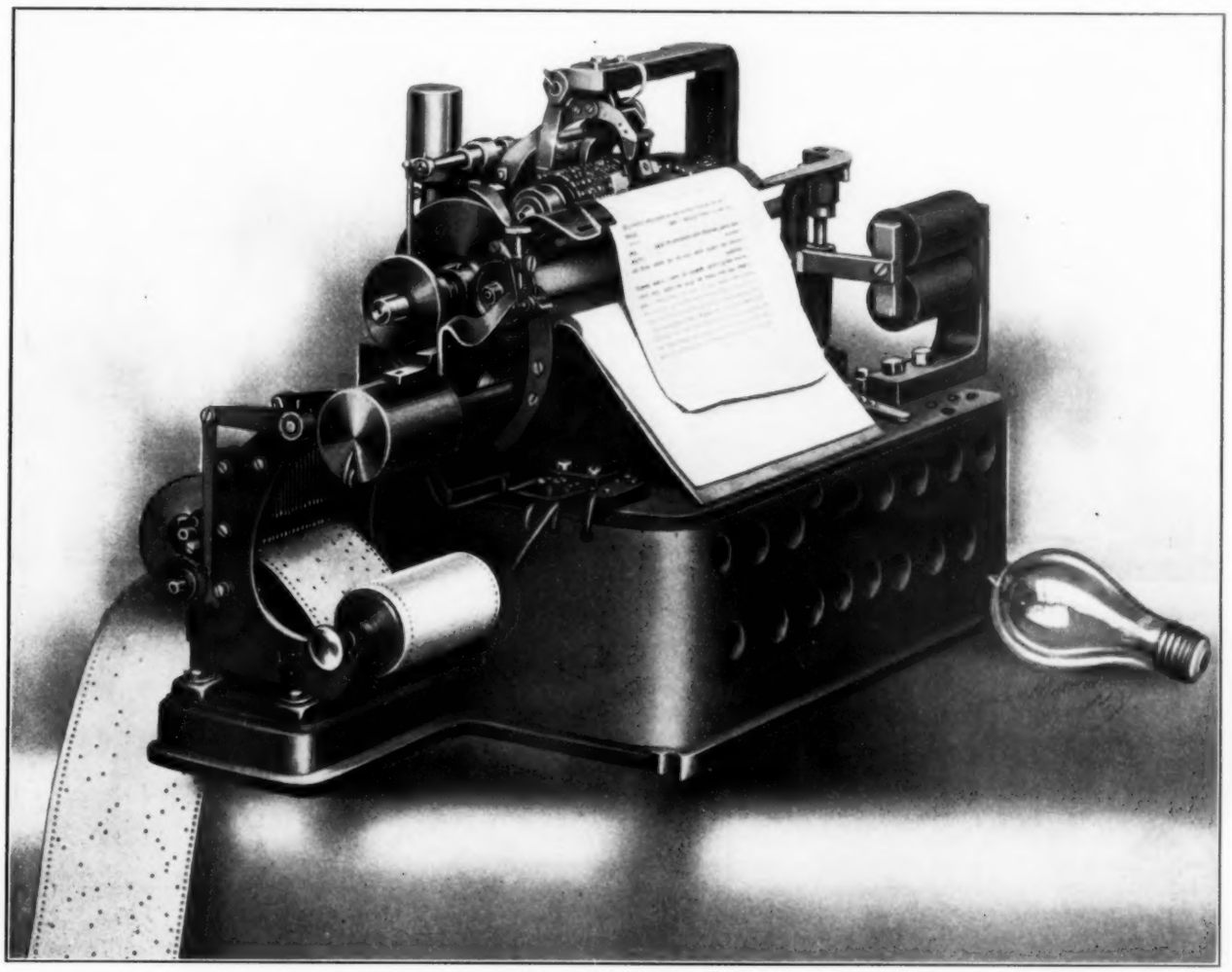


FIG. 5. TRANSFER PRINTING MACHINE.

the functions of printing and spacing but one is in operation at a time.

The bar *e* is traversed longitudinally at each letter and space and, by a lug *f*, drives the sleeve *g* in one direction, the return movement being by a spring, the amount of this return movement being determined by one of the stops *a*, which is thrown up. This amount of movement is carried by connecting rod *h*, arm *i* and a pawl to the ratchet *j*, of which each tooth represents a unit of space, and from *j* it is carried to the paper.

Since all letters in a circle of the type cylinder are of the same number of units in width, it follows that the lifting of a stop *a* for any letter in a circle can be made to determine directly the movement of sleeve *g* appropriate for the spacing for that letter. The spacing between words, or justifying, is, however, a much more complex matter, although it is accomplished by the same set of stops.

Fig. 7 is a vertical cross-section between two of the stops *a*, one of which is shown. The sleeve *g* is also shown splined upon its shaft and fitted with two stop pins *p q*. Stop *a* carries a bracket *r* for operating the between-word space stop *s* and a bracket *t* for operating the between-letter space stop *u*. The rotation of the splined shaft causes stops *p* and *q* to front stops *s* and *u* according to requirements. When the line *a b* of Fig. 3 passes under the contact needles the needle opposite the unit hole causes the corresponding stops *a* and *s*, Fig. 7, to rise, and the locking bar *v*, by a slight movement, locks the stop *s* in the elevated position, where it remains until at the end of the line it is thrown down and another is raised. Throughout that line whenever one of the space trip holes of Fig. 3 passes under a needle, the splined shaft and sleeve *g* are turned, causing stop *p* to come in line with *s*, which latter thus determines the

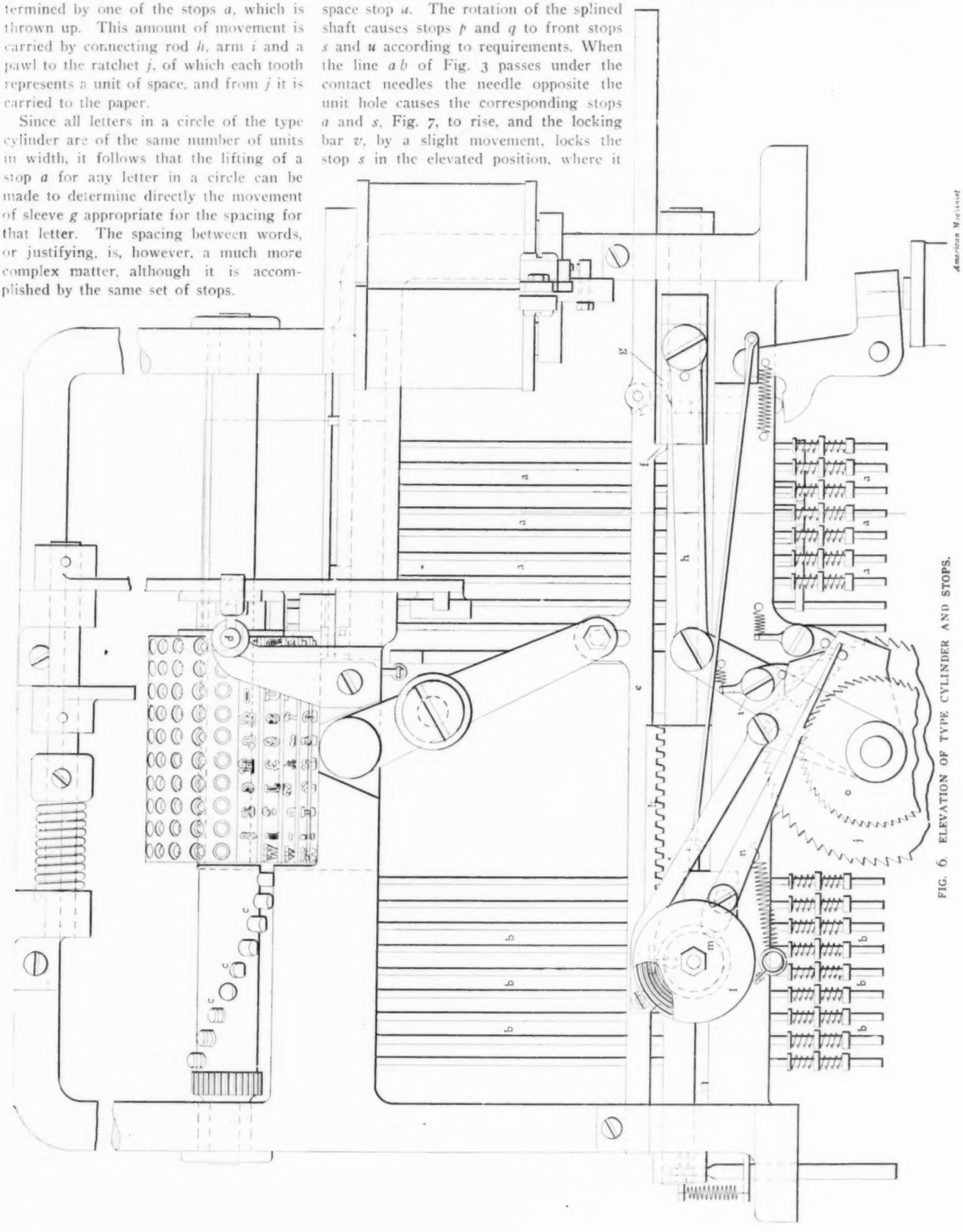


FIG. 6. ELEVATION OF TYPE CYLINDER AND STOPS.

longitudinal movement of sleeve *g*, and through it of the paper. On the other hand, whenever a letter is called for by the punched strip, the splined shaft and the sleeve *g* are turned in the opposite direction, turning stop *p* away from *s* and bringing *q* in position to engage with whichever one of the *u* stops has been thrown up by the raising of the corresponding *a* stop.

The bar *e*, Fig. 6, also reciprocates a rack *k* which by a ratchet and pawl drives the disk *l*, the extent of the movement of the rack being determined by one of the stops *b*, which has been thrown up, precisely as the movement of sleeve *g* is determined by the *a* stops. The movement of the disk represents the tenths of space, a revolution being completed when the accumulated tenths aggregate a unit, and

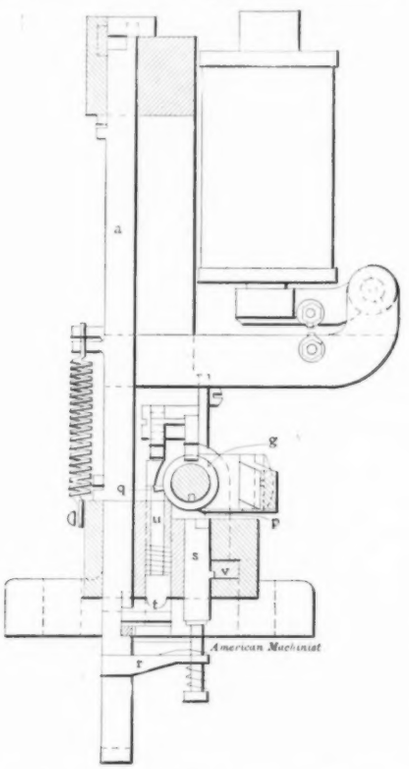


FIG. 7. ACTION OF LETTER AND SPACE STOPS.

at this point a depression *m* acts upon a pawl lever *n* which in turn acts upon the ratchet wheel *o*. This ratchet has the same number of teeth as its larger companion ratchet *j*, and a movement of a tooth thus represents a unit of space. Inasmuch as this movement only takes place when the accumulated tenths aggregate unity no movement will be made for the tenths which remain at the end of a line. The movement of the ratchets is carried to the paper by means which need not be described in detail.

There are of course a large number of minutiæ and refinements made necessary by and introduced to provide for various contingencies, but the general action of the machines will, we think, be clear from what has been given.

Treatment of Punches.

BY E. R. MARKHAM.

Piercing punches are often used to penetrate a fairly mild grade of stock whose thickness is considerably less than the diameter of the punch. Ordinarily under such circumstances very little trouble is encountered, and almost any grade of tool steel that will harden can be used with satisfactory results. Unfortunately, we cannot always use exactly the thickness and grade of stock that will cause us the least bother when machining, but are compelled to accept the circumstances as they present themselves and to use such stock as is necessary for the job. We sometimes find it necessary to punch a 5-16 inch hole in stock considerably more than 5-16 inch thick, and perhaps our troubles are further increased by having to use hard, stiff stock.

Where the strain is not very great, drill rod is often used for round punches, it being approximately straight and true to size. It can be held in a spring chuck and the end which is to do the punching can be easily turned to size, and in this way the punches can be made very cheaply. For general work, however, drill rod does not prove satisfactory for punches; yet this fact need not influence the man who has found it to work satisfactorily on the work he is doing.

As stated in a previous article, it is not generally considered advisable to use a *high carbon* steel for punches, and, in fact, high carbon steels are not as a rule advocated for tools in general when a lower carbon will answer. The reason for this is that so few hardeners realize the extreme care required when heating the steel. As a low carbon steel is not as sensitive to the action of heat as that of a higher carbon, it is policy for steel manufacturers to advocate that which will prove the most satisfactory in the hands of the *ordinary* workman, as the steel will be judged by the results in the hands of such men as happen to get hold of it, and not by what it might do were it handled by those fully skilled in the various operations it must be subjected to.

Many concerns have found out to their sorrow that a certain steel made into tools and hardened by an expert whom the steel company had suggested and which proved highly satisfactory under such circumstances, gave very unsatisfactory results when hardened in their own shops by men not skilled in that particular branch, and who also were compelled to labor under adverse conditions because the equipment was not adapted to the work.

It is an unfortunate fact that in many shops very little attention is given to the location of the furnace used in heating steel for hardening, and it is often placed where the direct light shines either in the fire or in the eyes of the operator. In either case it is not possible to detect the proper heat color, and as a consequence steel is *over heated*. This is damaging to any steel, but is especially harmful to one of *high* carbon.

While it is considered advisable, when it will answer, to use a comparatively low carbon steel for punches, it is still a fact that for operations requiring great strength in the punch, a steel containing 1.35 per cent. or even 1.40 per cent., carbon answers the purpose better than a steel of lower carbon, provided that it is low in percentage of harmful impurities and is properly heated when forged, annealed or hardened.

All steel should be hardened at *its* refining heat, and as the refining heat of high-carbon steel is lower than that of a lower carbon of the same make, it is readily apparent that in order to get the best results possible it is necessary to use the utmost care, and not heat above the proper hardening heat for the particular brand we are using.

Steel is the strongest possible when hardened at *its* proper heat. The exterior may not be as hard as though it were heated a *little* hotter; but as a rule that is of little account in a punch of the type under consideration, where extreme hardness is not necessary.

Where punches are to be subjected to hard usage, experience has convinced me that better results are obtained if the steel is forged to shape, provided, of course, that the heating and hammering are properly done, than if they were made from the bar as it came from the steel mill. Unless, however, the smith is skilled in working tool steel, I should prefer taking chances on punches made from the bar without attempting to *hammer-refine* it. All toolmakers know how much a piece of steel can be improved by hammering, and most of them will select a piece requiring hammering when making a tool that must be strong and tough.

Although as we get into the high-carbon steels the danger from overheating is materially increased, this should not keep the man who is manufacturing on a large scale from using it if it can be made to increase his output. He should at least find out whether his facilities for handling such steel are the best, and whether the tool-smith is competent. I think I am perfectly safe in saying that it is false economy to buy a certain steel when we are convinced that something better is to be had, simply because the smith cannot work the better to as good advantage. Many shops fail to get satisfactory results from the "high-speed" steels, simply because the smith cannot be made to see the necessity of following instructions implicitly.

The methods ordinarily used when drawing the temper of piercing punches have been previously described. It is customary, when drawing by means of a hot plate, to draw the temper considerably lower back of the cutting edge than it is at the end where the cutting is done. In many cases where heavy punching is done

—and by heavy punching I mean punching that is heavy for the punch we are using—the punches are left of the same temper their entire length, thus insuring a uniform stiffness, and this makes the punch last longer.

Mechanics differ in their ideas as to the proper shape of the piercing portion of a punch, some claiming that it should be straight, while others claim best results when it is made somewhat smaller back than on the cutting edge. Other mechanics, again, having broad experience in this particular line, claim vastly better results when the punches are made smallest at the cutting end and growing larger as they go toward the shank. The claim made for this latter method is that the slightly larger portion of the punch, entering the stock after the point has penetrated, expands the hole sufficiently to prevent its closing on the punch and hugging it when stripping, they claiming that this action of the scrap has a tendency to pull the punch apart or to snip off the cutting edge. The particular practice in the making and the actual shape of the punch must, however, conform to the conditions in the individual shop. It is still a mistake to think that because we have always used a certain thing or method, it must necessarily be the best; we may wake up some morning and find our competitor is so far ahead of us that we can never overtake him.

It is generally understood that boilers and other things explode because they are not strong enough to withstand the pressure within. The *Brewers' Journal*, referring to fatal explosions of steam cookers, says "the chief cause in any case can only have been that the pressure-resisting power of the apparatus and the pressure itself *were not properly balanced*. Whether an excess of "pressure resisting power" would have been dangerous we are not informed.

An English Design of High Speed Lathe.

The accompanying illustrations show a lathe for use with high-speed steel, which is the product of Miley's Machine Tool Company, of Keighley, England. The large illustration, Fig. 1, will serve to remind our American readers of the characteristic differences between English and American lathes, but the new features of the design being confined to the headstock, we show in Fig. 2 an enlarged illustration of that member with the gear cover removed.

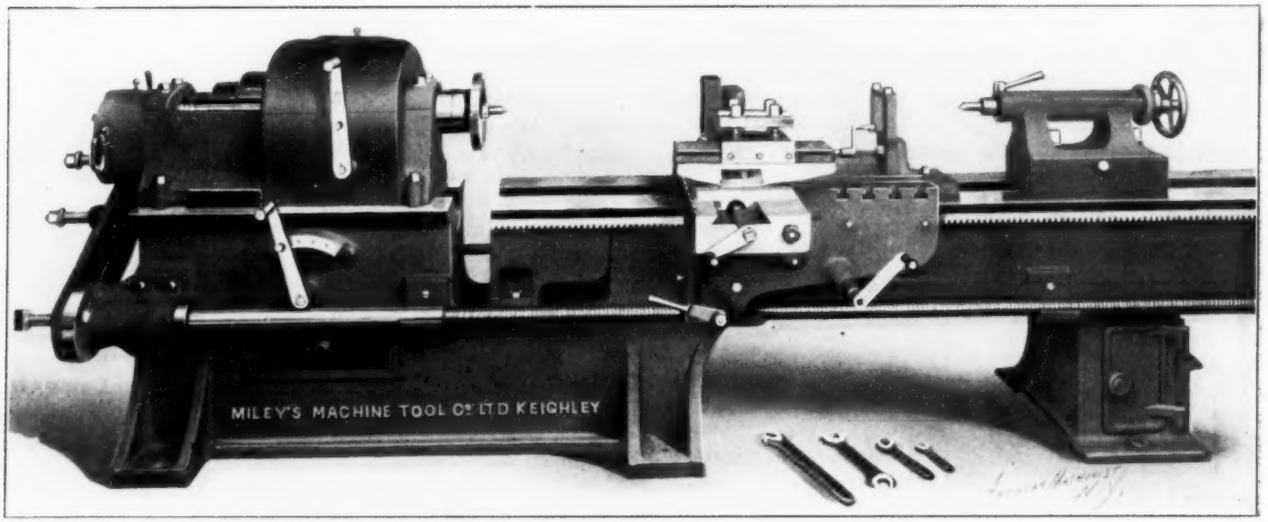


FIG. 1. AN ENGLISH HIGH-SPEED LATHE.

The chief change will be seen to be in the location of the cone pulley, which is mounted on a prolongation of the eccentric shaft for the back gears. The cone pulley carries directly a raw-hide pinion *A*, which drives a gear *B* on a quill occupying the usual cone pulley space. The back gears *C*, *D*, *E*, *F*, of which *C* is integral with *B*, are operated by the eccentric shaft in the usual manner, the prolongation of this shaft on which the cone pulley is supported being concentric with its supporting ends, so that gears *A* and *B* are always in mesh. A clutch on the main spindle between the back gears serves to engage gear *C* or *F* with the spindle, as desired.

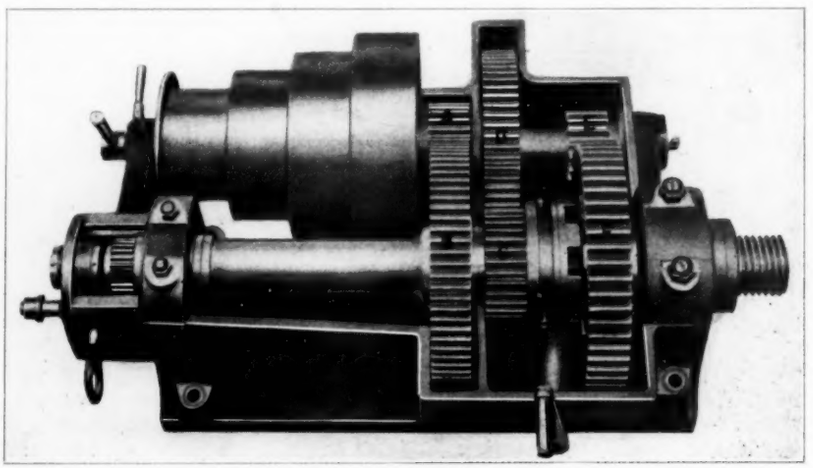


FIG. 2. HEADSTOCK OF HIGH-SPEED LATHE.

The changes in the lathe being confined to the headstock, it is the practice of the makers to supply new headstocks to fit existing lathes, and thus at small cost to adapt them to the new steels. Both lathes and headstocks are made of 9, 10, 12, 18 and 24 inches center, or, according to American designation, 18, 20, 24, 36 and 48 inches swing. One of these 12 inches center (24 inches swing) headstocks, fitted to an existing lathe at the works of John Brown & Co., of Sheffield, was recently tested, with the following results: Turning a 10-inch steel shaft of composition carbon, .31 per cent.; silicon, .09 per cent.; sulphur, .036 per cent.; phosphorus, .042 per cent., and manganese, .62 per cent., 8¾ pounds of chips were removed per minute. The peripheral speed of the work was 49 feet per minute, the cut being ⅜ and the feed 1-7 inch per minute.

The tables give the pulley and gear combinations and the resulting speeds. We give these because, having calculated two of them, we find them in remarkably close

Cone Speed.	200	260	320	416	500	650	800	1040	Revs. of Cone.
1st Gear.	57	74	91	118	142	185	228	295	Revs.of Spindle
70 ft. per min.	4.7″	3.6″	2.9″	2.3″	1.8″	1.5″	1.1″	0.8″	Diam. Turned.
2d Gear.	8.8	11.4	14.0	18.3	22	28.6	35.2	45.8	Revs.of Spindle
70 ft. per min.	30.4″	23.5″	19″	14.6″	12.2″	9.3″	7.6″	5.8″	Diam. Turned.

Countershaft speeds, 400 and 520 revolutions per minute.
Cone pulley, 6, 8, 10 and 12 inch diameter by 3 inch face.

First gear combination, $4\ P\frac{57}{16} = 3.5$ to 1 ratio.

Second gear combination, $4\ P\frac{57}{14}$, $4\ P\frac{43}{27}$, $4\ P\frac{56}{14} = 22.7$ to 1 ratio.

SPEEDS, GEARS AND CONE PULLEYS FOR **9** INCH CENTER LATHE.

Cone Speed.	164	205	302	377	529	662	975	1218	Revs. of Cone.
1st Gear.	51.2	64	94.4	118	165.6	207	304.4	380	Revs.of Spindle
70 ft. per min.	5.3″	4.2″	2.8″	2.2″	1 6″	1.3″	0.87″	0.7″	Diam. Turned.
2d Gear.	5 48	6.85	10.12	12.65	17.72	22.15	32.5	40.75	Revs.of Spindle
70 ft. per min.	50″	39″	26.5″	21″	15″	12″	8 3″	6.3″	Diam. Turned.

Countershaft speeds, 400 and 500 revolutions per minute.
Cone pulley, 6, 8⅞, 11¾ and 14⅝ inch diameter by 4 inch face.

First gear combination, $4\ P\frac{64}{20} = 3.2$ to 1 ratio.

Second gear combination, $4\ P\frac{64}{20}$, $4\ P\frac{56}{24}$, $4\ P\frac{48}{12} = 29.8$ to 1 ratio.

SPEEDS, GEARS AND CONE PULLEYS FOR **10** INCH CENTER LATHE.

Cone Speed.	200	250	320	400	500	625	800	1000	Revs. of Cone.
1st Gear.	66	83	106	133	166	208	256	333	Revs.of Spindle
70 ft. per min.	4″	3.2″	2.5″	2″	1.6″	1.2″	1″	0.8″	Diam. Turned.
2d Gear.	10	12.5	16	20	25	31	40	50	Revs.of Spindle
70 ft. per min.	26″	20″	16″	13.3″	10″	8.8″	6.6″	5.3″	Diam. Turned.

Countershaft speeds, 400 and 500 revolutions per minute.
Cone pulley, 9, 12, 15 and 18 inch diameter by 5 inch face.

First gear combination, $4\ P\frac{72}{24} = 3$ to 1 ratio.

Second gear combination, $4\ P\frac{72}{24}$, $4\ P\frac{60}{32}$, $3\ P\frac{54}{13} = 20$ to 1 ratio.

SPEEDS, GEARS AND CONE PULLEYS FOR **12** INCH CENTER LATHES.

Cone Speed.	215.2	269	327.2	409	488.8	611	743 2	929	Revs. of Cone.
1st Gear.	53.8	67	81.6	102	122	152.5	185.6	232	Revs.of Spindle
70 ft. per min.	5″	4″	3.2″	2.6″	2.2″	1.8″	1.5″	1.2″	Diam. Turned.
2d Gear.	9.5	11.9	14.5	18.1	21.7	27.1	33	41.2	Revs.of Spindle
70 ft. per min.	28.2″	22 4″	18.4″	14 8″	12.3″	9.8″	8.1″	6.4″	Diam. Turned.

Countershaft speeds, 400 and 500 revolutions per minute.
Cone pulley, 14, 18, 22 and 26 inch diameter by 6 inch face.

First gear combination, $3\ P\frac{88}{22} = 4$ to 1 ratio.

Second gear combination, $3\ P\frac{88}{22}$, $3\ P\frac{71}{36}$, $2\frac{1}{2}\ P\frac{66}{25} = 22\ 5$ to 1 ratio.

SPEEDS, GEARS AND CONE PULLEYS FOR **18** INCH CENTER LATHES.

Cone Speed.	115	150	184	240	287.5	375	460	600	Revs. of Cone.
1st Gear.	25 5	33.3	40.8	53 3	63.8	83.3	102.2	133.3	Revs.of Spindle
70 ft. per min.	10″	8.1″	6.6″	5″	4.2″	3.2″	2.6″	2″	Diam. Turned.
2d Gear.	3 8	5	6.1	8	9 5	12.5	15.3	20	Revs.of Spindle
70 ft. per min.	70.5″	53.5″	44″	33″	28 2″	21″	18″	13 3″	Diam. Turned.

Countershaft speeds, 230 and 300 revolutions per minute.
Cone pulley, 15, 20, 25 and 30 inch diameter by 7 inch face.

First gear combination, $3\ P\frac{103}{23} = 4.5$ to 1 ratio.

Second gear combination, $3\ P\frac{103}{23}$, $2\frac{1}{2}\ P\frac{70}{32}$, $2\ P\frac{62}{20} = 30$ to 1 ratio.

SPEEDS, GEARS AND CONE PULLEYS FOR **24** INCH CENTER LATHES.

accordance with that true geometrical progression which is now attracting so much attention in this country.

Echoes From the Oil Country—Getting Answers to Mail Inquiries.

Sammy thinks that he "has a kick coming," to use a common shop expression. Sammy is high up in the machine business just now and wants to get higher. He is just a little bit higher up than a gang boss, and as he has been getting up in proportion as the business has increased, he is anxious to have it keep right on increasing.

Years ago Sammy got into the habit of writing around to various advertisers for their circulars and catalogs. Sometimes he never heard from his letters, but often he got more of a book than he had expected, and that would make him feel good for a long time.

If the thing that he wanted information on was of such a nature that the catalog was likely to be expensive, he would state that he was not going to buy the article or machine, but that he was a machinist who was afraid that he might be called upon at some time to fix one, and wanted to know enough not to get stuck.

When he received "A Treatise on Files," and saw on the title page that it was intended for the use of master mechanics, he felt somewhat afraid that he had not been plain enough in stating that he was not a buyer, especially as there was a price list with it; but he received also a letter from the firm stating that while they understood that he was not a buyer, yet they were glad to furnish him with the book, and as they thought he might be interested in knowing what files really cost, they had enclosed a price list, which was subject at that time to a discount of —— per cent., and if in the future he should need to know the current price, they would be glad to furnish him with the latest one.

It would be hard to convince Sammy that that firm did not make good goods when they were willing to try a long shot like that, and if any master mechanic got more information out of his copy than Sammy did out of the one that fell into his hands, that master mechanic was good on absorbing.

Now Sammy's inquiring has taken another turn, and this time he is not so well pleased at his treatment as he would like to be.

You see, it is this way. Sammy is Mr Dier's right-hand man all right, and wants to keep on being so, and he has learned that it is not of any use to be bothering the owner of the shop about every idea that happens to strike him; many of them are poor. In his browsing around on the lookout for ways of getting out the work better, he sees an advertisement of a thing which is recommended as a great labor-saver, and he wonders if it would be a good thing for their work. He sends

a letter on plain paper, and never gets a reply, or if he does the price given is the list price only, and the catalog contains a little notice that says: "Send us a list of your requirements and we will quote discounts." Sammy hasn't any requirements as yet. He is only trying to find out whether it would pay the shop if he did have.

After a number of experiences of this kind he tries using the shop stationery (with Mr. Dier's consent), and thinks that now he can get the information that he is after without any more trouble. Here are some of the results, and you will remember that Sammy had not signed any but his own name in getting them. It is true that he had signed that name in a variety of styles. He had first signed it "Sammy Short," and as he thought that the number of replies was not in proportion to the number of letters that he wrote, he signed some of them "Sammy Short, Foreman." This still seemed lacking in results, and he signed some "Sammy Short, Foreman Dier Machine Works." This, he reasoned, would give the parties an opportunity to see that he was working for a responsible party. While he did not feel that it was necessary for him to give all the details of his past life and all of his hopes and plans for the present and future, he did try to make it plain in his letters that while he was not a company nor the purchasing agent for one, yet he did want the information for a reasonable purpose.

To return to the results obtained: Here is a good article, with a list price on it of $12. If that price is net there are other things to fill the same need that are cheaper to get and use; if it is subject to 25 per cent. discount it may be considered in comparison with the other; if it is subject to 60 per cent. discount Sammy will take the chances of bringing it to Mr. Dier's notice in such a way that he will get as many as the shop will need; if it is subject to a discount of 80-10-10-5 and 2½ Sammy will send the money for one at once and give it a trial on his own responsibility, and if it is not a success he will feel that the experience has gone a long way toward paying him back his money. The only information that he gets, however, is that the list price is $12.

In another case he got even more results than he wished for. A man came in who said he had been sent to see what their requirements were and to send them a machine guaranteed to meet these requirements. This man seemed to feel hurt to think that anyone should want to know anything about a machine that he was not ready to buy.

The firm that kept writing letters for months, calling attention to the fitness of their output for all sorts of uses, ordinary and extraordinary, and kept asking for a statement as to where it was supposed to be lacking, evidently had a good system of keeping track of all inquiries, but they almost scared Sammy away from his investigations. The worst of it was that these letters were addressed to Mr. Dier.

Mr. Dier received a lot of mail that found a quick burial in the waste basket, and it was no strange thing for him to come to Sammy with a letter that made mention of circulars that had been forwarded and state that he believed those same circulars had arrived ahead of the letter and had been consigned to the waste basket along with other, to him, rubbish. If the circulars did not arrive until some time after the letter, they were quite sure to go the same way. A busy business man has about all that he can do to remember all of his immediate concerns, without trying to keep track of every idea that his foreman is trying to get posted about.

Perhaps someone with a wider experience than I have had can tell Sammy how to write and sign his letters so that he will get answers to all of them; so that the answers will be addressed directly to him; so that they will give him the information that he needs, and will not try to make him feel that he is under an everlasting obligation because his inquiries were noticed.

Plain paper hardly fills the bill when he wants to know the particulars concerning an electric crane, yet if he uses company paper the answer is almost sure to go to Mr. Dier, and will say: "At request of your Mr. Sammy we send you cuts of our latest crane. When you are in the market we will be glad to send a man to take up the matter with you." Perhaps such a crane would be the very thing needed in that new shop that is being talked about and should be provided for. No one knows how much it could be used better than Sammy does, and if he knew about what one would cost, and how much current it would take, he could form a kind of an idea about whether he could make it pay. He does not know whether one would cost $200 or $3,000. He does not know whether it would cost 4 cents or 40 cents an hour for current. He does know that if they put in a crane that could be used only at a loss, everyone for miles around would know that he had been the means of having it put in.

I believe that most of the firms addressed would be willing to give the information needed, but it seems that in their systems of doing business there is no provision for the man who wants knowledge of their product for purposes ultimately profitable to them although he is not a buyer of it.

A superintendent, foreman or workman does not like to recommend a thing unless he knows the price of it, when its value for the place may all hinge on the cost; there are very few things connected with a machine shop that are not vitally influenced by the question of cost.

The answering a letter signed "Sammy Short," in which it is stated that the information is wanted by the writer for the purpose of seeing if the article is suitable for work that he has in hand, by sending a letter to someone else whom the writer happens to be working for may be according to instructions, and may be done by some clerk who takes orders literally (perhaps he dare not take them any other way under the circumstances), but it seems a long way around if results are desired.

It may be as effective as a very nice letter that came to me a few days ago. It was from a prominent company, and after telling of the pleasure our former dealings had given them, and of the appreciation with which our commands had been received, they expressed regret that recently the orders had not been coming. After assuring us that their facilities for doing good work had been greatly improved and that now they were unexcelled by anyone, they begged that we would feel free to use their wide experience. All of our orders would, of course, receive immediate personal attention. If orders received the same care that their imitation personal letters do, someone would be in trouble at least part of the time. We had as much use for the product of that firm as we have for a building lot in Patagonia.

Perhaps some day Sammy may have trouble trying to have proper answers sent to all the different letters that come to him, and then he may find that there is trouble on the other side also.

W. OSBORNE.

Flexure of Long Beams.

BY H. REISSNER.

In the columns of the AMERICAN MACHINIST, at pages 54, 85, 116 and 147, Vol. 25, and later on in book form, Mr. Albert E. Guy has given the results of some very interesting experiments conducted to investigate the laws governing the failure by buckling of beams strained by bending.

It is to be regretted that Mr. Guy has failed to read a paper by A. G. M. Michell, Melbourne, Australia, "On the Elastic Stability of Long Beams Under Tranverse Forces," which appeared in the *Philosophical Magazine*, September, 1899, pages 298-309, where Michell by a very clever application of the differential equations of the line of deflection in space develops formulas for the following cases:

(1) Cantilever loaded vertically by a single force.

(2) Beam supported and prevented from turning about its axis at its ends and loaded by a single transverse force at its middle point.

(3) Beam supported and completely clamped at its ends and loaded with a single transverse force at its middle point.

(4) Cantilever loaded vertically by a uniformly distributed load.

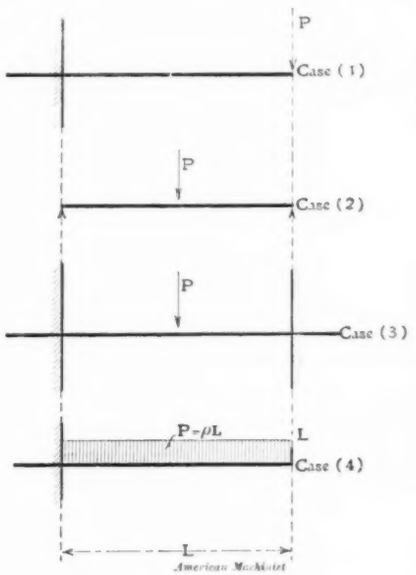
Then he shows the intrinsic connection between the above cases and the well-known column formula of Euler, and at last verifies his results numerically within one per cent. by experiments with an en-

gineer's steel straight-edge. His formulas can be given in the form:

$$P L^2 = m \sqrt{E \frac{I_1 I_2 C}{I_1 - I_2}}$$

where

P = the load,
L = the length of beam,
E = the Young's modulus,
I_1 = the largest moment of inertia of the cross-section,
I_2 = the smallest moment of inertia of the cross-section,
C = the torsional rigidity, viz., the quotient of the moment of torsion divided by the angle of torsion per unit of length.
$m = 4.00$ for case (1),
$m = 16.96$ " (2),
$m = 80.40$ " (3),
$m = 12.85$ " (4).



VALUES OF m.

Michell makes the assumption in his analysis that C must be small in comparison with $E I_1$.

Mr. Guy's first law concerning the constancy of the product $P L^2$ agrees perfectly with Michell's results, but the other laws asserted by Mr. Guy, especially the one stating the equality of critical column load and critical transverse force can be proved to be erroneous and conforming only with Mr. Guy's special experiments by a curious coincidence of figures. Even this coincidence is not at all satisfactory, the error being about 15 per cent. or more (see Tables 1-4, page 48) and occurs only because Mr. Guy used test specimens of rectangular cross-section made of white pine wood with a very peculiar proportion between the coefficient of elastic compression E and the coefficient of elasticity of shearing G.

A law corresponding to Mr. Guy's third law about the combination of efforts for several forces can be deduced from Michell's integral equations without great difficulty. I have tried it and found that the expressions are rather complicated and do not even approximately agree with Mr. Guy's third law.

As simple and correct as Michell's formulas are, there is a great embarrassment in applying them to technical problems because the torsional rigidities are not yet known for many sections, especially those with reentrant angles like the standard steel structural shapes such as angles, channels, Z and I bars.

We will try now to find out what becomes of Michell's conditions of critical stability in the case treated experimentally by Guy, viz., a cantilever beam of thin rectangular cross-section made of white pine wood.

The torsional rigidity of a rectangle of sides h and b ($h > b$) is, according to St. Venant's, theoretically and experimentally well-founded theory:

$$C = n G h b^3 = 12 n G I_2$$

where G = the coefficient of elasticity for shear and n is a factor depending on the proportion of the sides in the following manner:

$$n = \frac{1}{3} - 0.2108 \frac{b}{h} - 0.0075 \frac{b^5}{h^5} \; *$$

Mr. Guy should have determined the torsional rigidity of his test pieces as Michell did for the experimental investigation. As it is now, we can only take a value of G for white pine from Prof. Burr's treatise on "Elasticity and Resistance," page 548, given for the first time in a table by Prof. Thurston in the "Journal of the Franklin Institute" of 1873, page 260, determined by his torsion machine with small specimens, namely:

$G = 220{,}000$ pounds per square inch.

Let us select case 8 of Mr. Guy's tests, where $E = 1{,}488{,}200$ pounds per square inch, $I_1 = 0.125$, $I_2 = 0.0011$, $\frac{h}{b} = \frac{32}{3}$; then according to Michell's case (1)

$$P L^2 = 4 \sqrt{E G 12 n \frac{I_1 I_2^2}{I_1 - I_2}}$$

$$n = 0.312,$$

$$P L^2 = \text{approximately } 4{,}890.$$

This result, in spite of the uncertainty of the value of G for Mr. Guy's material, is in much better agreement with the experimental figure 4,670 than the Euler formula, which would give 4,034.

But the approximation of Euler's column formula can be shown to be only an accidental coincidence of figures for the peculiar value of $\frac{G}{E} = \frac{22}{14.88}$, as in the case of white pine and for the rectangular section.

For more isotropic materials, like steel and other metals, we have $\frac{G}{E} = 0.45$, while for thin rectangular sections we can write

$$\frac{I_1 I_2^2}{I_1 - I_2} = I_2^2$$

$$n = \frac{1}{3}$$

and so we get

$$P L^2 = 4 E \sqrt{\frac{0.4512}{3} I_2^2} = 5.37 E I_2,$$

which is more than double the constant $P L^2$ resulting from Euler's formula, and which agrees within 1 per cent. with Michell's experiments on an engineer's steel straight-edge 110 centimeters long, 4.367 centimeters wide and 0.2591 centimeter thick.

There has been much discussion lately about the necessity and usefulness of the science of mechanics and mathematics for the art of engineering. One conclusion at least one is tempted to draw from the comparison of the two papers referred to above, namely, that every problem has its natural mathematical difficulty, which must be tackled, and though the calculus may be only a burden sometimes to the practical engineer, yet there ought not to be any doubt that it is necessary for the men who want to bring the results of experimental investigation into a useful and reliable system.

Technical College of Berlin, Germany.

[The above criticism of Mr. Guy's work was submitted to him, and the following is his reply.—Ed.]

I agree entirely with Dr. Reissner that it is regrettable that I have failed to read A. G. M. Michell's work "On the Elastic Stability of Long Beams Under Transverse Forces." For excuse I submit that, quite regularly, I find my way through twelve technical periodicals, and that, before undertaking the experiments on the flexure of beams, I searched through text books and publications printed in four different languages, and finding nothing definite, and wanting the information for use in my daily work, I decided then to experiment, and having met with tangible results, published these in the columns of the AMERICAN MACHINIST.

It is quite regrettable, also, that Dr. Reissner has not read thoroughly the accounts of my experiments, for he would have seen that the error of 15 per cent. or more, which he states is shown in tables 1 to 4, page 48 of my book, is purposely exemplified in said tables, to illustrate the ease with which a *bona-fide* experimenter may be misled into misinterpreting the results he obtains. Thus, after testing the beams and tabulating the data alluded to, I felt that the laws governing the case at hand were very irregular, and was at a loss to explain the reason therefor, but, true to my aim, I simply wrote the data down without allowing my fancy to find imaginary refuge and comfort in the vagaries of a mathematical theory of my own, which, quite naturally, I might

* See Résumé des leçons de Navier. Troisième édition, Paris, 1864, avec des notes et appendices par B. de St. Venant, p. 346.

have nursed into such a state that it would have given apparently plausible explanations for all the irregularities of the specimens under test. It was only after conceiving the angular method of testing that, while proceeding with the experiments and being absolutely unable to obtain any satisfaction, I found the cause of my troubles. Through an error of observation I had allowed the rods sustaining the testing load to be connected somewhat rigidly to the specimen, and, in consequence thereof, the end of the latter was guided vertically—in the direction of the load—and prevented from assuming freely the double curve in space which was expected. To remedy this defect the suspension parallelogram shown in Fig. 9, page 55, was devised and all the experiments previously made were taken up anew, and, as stated at page 56, sixth line from top: "With this apparatus, the bars were again tested in the four positions previously described, and, curiously enough, were found to give way by buckling under exactly the same loads that caused the buckling in the fifth or vertical position." It should be remembered that upward of 200 specimens were tested, making thus more than 3,000 distinct tests of rectangular as well as T and I section, and, although almost the whole of them were of wood, some were of steel. The utmost care was exercised in experimenting, and it was found in an absolute manner that the elastic stability of any of these bars was a constant for all positions from the vertical to the horizontal.

It is true the specimens were of diminutive size, and mostly of wood, but I claim that for these reasons the action of the load and the consequent deformations were better observed, the various axes more readily found, and the reactions of the supports and of the load-suspension system were more easily kept within their proper limits and prevented from interfering with the free deformation of the specimen, than would be the case with test pieces of the so-called practical dimensions, which may generally be considered as exceptions to every known rule, because of the heterogeneity of their constituent parts at various points of their length and cross-sections.

As stated by Dr. Reissner, Mr. Michell established a theory and proved it by experiments with an engineer's straightedge. For the general public interested in this matter, this is hardly sufficient. What is wanted is experimental data, plentiful, carefully obtained and complete; then the establishment of a sound theory becomes an easy task. Otherwise—that is, if we start by establishing a theory—we start by guessing, surmising, and later, in experimenting, we generally wonder why nature has the bad taste to refuse to shape her laws according to our specified wishes.

In describing my methods of experimenting I have been very careful to go into minute details, so as to allow anyone to repeat the tests, and it is as well to remark here that at a very little cost all my work can be gone over again, analyzed and either verified or disproved. My apparatus and the specimens were not expensive, for obvious reasons, for, not having at my disposition real testing machines, I had to fall back on what little ingenuity I could command; but I believe that, in the end, proved to be an excellent thing, for while starting by devising complicated systems for testing, I finally evolved the simplest method conceivable and reached the long-sought goal, viz., the discovery of the principle, pure and simple, governing the case. However, with proper apparatus, laboratory, time and means, I readily confess that much more complete results can be obtained than in my case, where the experiments were evolved in the realms of flat life, which embodies, as everyone knows, all the evils afflicting humanity, and several others besides.

Summing up, I would suggest that Dr. Reissner, being connected with an engineering college of Berlin, well equipped, as we may well surmise, should find it easy to investigate the matter fully, to the great benefit of the students of that college at first, and afterwards of the general public. He would follow then, in a parallel line, Professor C. Bach, of Stuttgart, whose extensive and thoroughly practical experiments on flat plates have enabled him to establish purely experimental formulas of great value. But before admitting that Mr. Michell's theory is right, reason demands that it be exhaustively corroborated by numerous and well-conducted tests.

This letter may be considered not only as answering Dr. Reissner, but also some of my English critics, *The Engineer* and others.

ALBERT E. GUY.

Forging Dies.

BY THOMAS BEASLEY.

One of the jobs set down as impossible to be done on the forging machine was the forming of "pin-ends" for switch work, but it was found by a little experimenting that they could be made very nicely and rapidly, so that what formerly cost 18 cents each could be made for 2 cents each by the new process. The pin-end is shown at *A*, Fig. 1, at the side of the dies in the same cut. *B* shows the iron as it comes from the squeezer, enlarged the small way of the iron and bent to a sharp angle so that the header will force it into the dies. The bending is done by the operator as the dies squeeze the iron, he forcing his end up to form the bend.

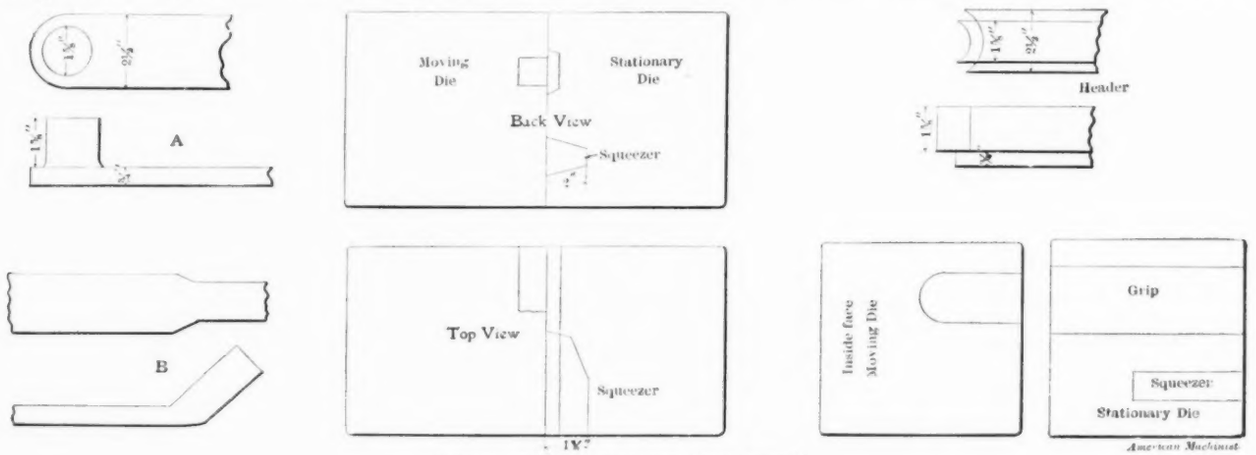


FIG. 1. FORGING-DIES FOR "PIN ENDS."

The squeezing and bending is the first operation, and the piece is reheated for the finishing upset and should be got very hot to do a good job. The moving die in the pin recess should be given plenty of taper and should be very smooth, so that the iron will slide into the recess without any trouble when the header strikes it. Any sharp corners should be carefully filed off or they cut the iron and the job looks bad when finished. The header should be tool steel. The inside corner which comes next the bar should be given an ⅛-inch rounding to form a fillet. It should be given an oil dip at a low heat.

It sometimes occurs that a job requires so much extra stock that to upset it would require going over it too many times and

would make the job so expensive that it would be cheaper to do it by hand. Such an obstacle I encountered in making a pair of dies for "head rods" on switch work. Fig. 2 *A* shows the rod. We tried upsetting the stock, but found that the outer end would waste away before we could get the desired amount of stock as we had to heat them four times, and the job when completed was very unsatisfactory. We decided to weld on a piece to gain the desired stock and so cut the heats down and at the same time the expense also. The bar being ¾x2½ inches, we took a piece 1½x2½x5 inches and laid it on the bar, heated it to a fair welding heat and upset in the machine, the dies so arranged as to round the back of the "dab" next the operator. The construction of dies, header and punch is given in Fig. 2.

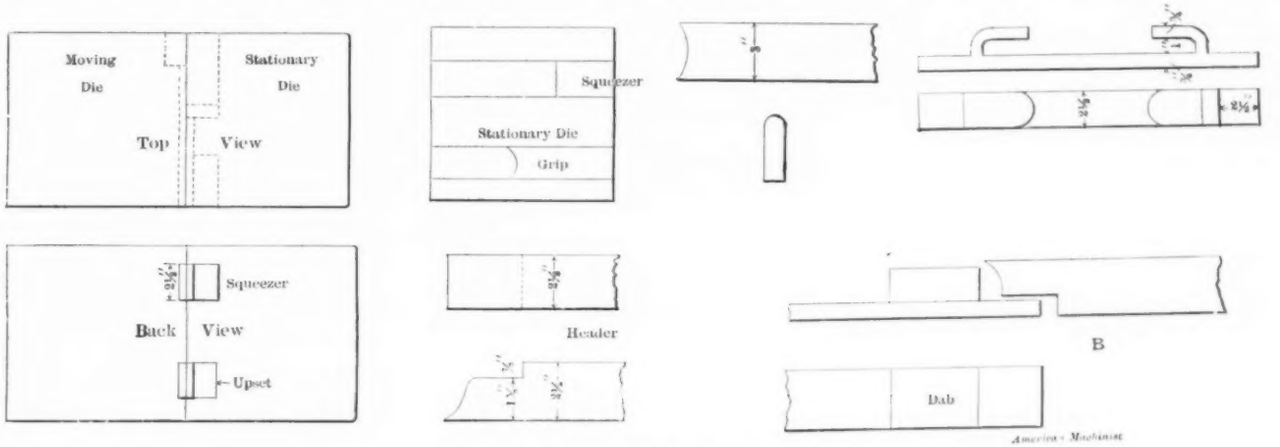


FIG. 2. MAKING "HEAD RODS."

In this operation there need be no heat at the portion next to the operator, as this part is punched out, but the part next the plunger should be a nice soft "snowball," as they express it. *B*, Fig. 2, showing the position of the iron as the plunger hits it, will make my meaning clear and also show the "dab" as it comes from the furnace. The operation consists in placing the "dab" or piece about ½ inch farther back than its final position, then placing carefully in the furnace (should be an oil furnace) and when a good soft heat is reached the "dab" will be stuck and the bar can be handled easily. Get it into the upper portion of the dies and let the machine squeeze it; then drop to the lower recess and upset it. This leaves the end ready for punching.

The arrangement of dies for punching the slot is practically the same as previously shown. Of course the finish of the dies, the clearance, the grips and the matching of them plays an important part. If the workmanship or the little details be neglected by the machinist, an expensive failure is apt to result.

I have one more die to show which is entirely out of the ordinary line of work done on these machines and does a very neat and quick job. This is an eye forming die for round, square or flat iron. The one shown here is for 1 inch round, as shown at *A*, Fig. 3. There is no header required, as it has no work to do in this case. It is necessary to have a 1 5-16 inch pin made to squeeze the eye over on the final operation, and there has to be a plug screwed in the moving die marked *X*, as this is the bender, and projects into the stationary die. When they are closed the blank is bent like *B*, this being the first operation. The eye is closed down just enough to hold the 1 5-16 inch steel pin and placed at an angle in the top recess of the die, so that the end of the iron is slightly above the top of the moving die. It is then ready to be squeezed to place and if it doesn't form the eye as it should and the end is not tucked to place, it should be squeezed a couple of times more and each time held straighter until it comes right, when the pin is knocked out and the eye is finished. The pin should be tapered at both ends and be about 3½ inches long. There should be several of these, as one gets hot and has to be cooled off. All the channels and recesses in these dies should have lots of clearance or they will give trouble. They should be scraped as smooth as it is possible to get them. Care should be taken also that they are just slightly larger than the finished eye. If too big the eye will not be good, and if too small they reduce the sides of the iron, and this is really worse than being too large. A good plan is to use an eye made just the right size by a blacksmith and fit the dies to this pattern, having them so that the eye works in the dies loose. No grip is used, as the bender on the first operation prevents the iron from slipping.

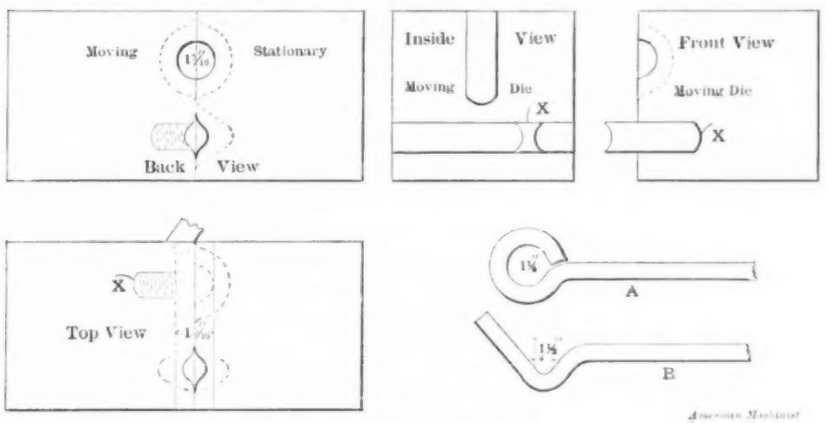


FIG. 3. FORMING EYE-BOLTS.

Legal Notes.

BY E. P. BUFFET, LL.B.

LIABILITY FOR A BOILER EXPLOSION.

In the case Anderson vs. Hays Manufacturing Company, passed on by the Supreme Court of Pennsylvania, the point at issue was the liability of the defendant, a manufacturer of brass and plumbing goods at Erie, Pa., for damage resulting to an adjoining hotel from the explosion of a steam boiler used in defendant's plant. This involved the question how far a boiler owner renders himself free from liability for negligence when he has it inspected. The boiler had been purchased in 1890 from a reputable manufacturer. In January, 1901, a leak was noticed in the shell. The manager of the Hays Company employed a competent boilermaker to inspect and repair it, which was done in a usual manner by a patch. In July a second and smaller leak appeared at the edge of the patch and a new one partly covering the old one was added by a skillful boilermaker who thoroughly tested

his work. The boiler remained in seemingly good condition till October 9, when it exploded. It was insured by a responsible company whose probably competent inspectors examined insured boilers four times a year. The last examination had been made about two months before the explosion, and the report had contained certain criticisms and suggestions, but had substantially stated that from the result of the examination the boiler was in good condition. After the explosion it was discovered that the boiler had probably not been in good condition at the time of this inspection. There was considerable testimony that a thorough examination at the time the second leak, or of the insurance company's inspection, would have disclosed a "groove" which would have led to condemnation of the boiler.

Judgment was rendered by the trial court for the plaintiff, but this has been reversed by the Supreme Court, which has returned the case for retrial. The opinion of the latter court is too long and complicated to follow in detail, but it seems to be guided by substantially the following principles: That an owner of a steam boiler is not absolutely responsible for damage resulting to strangers from its explosion, but only when this is due to his negligence, *i. e.*, neglect to fulfill a legal duty resting on him. Not being himself an expert, he cannot be expected to crawl into the manhole personally to make the examination (and indeed it would be negligence to depend on his own judgment). He exempts himself from responsibility if he takes all reasonable care to have the boiler properly inspected, even though damage result from an inspector's negligence, but his obligation to look to due fulfillment of this inspection is pretty rigorous. To quote the language of the court:

"It was the duty of the defendant acting by its officers, to employ competent mechanics to make the repairs, to exercise reasonable care in ascertaining their competency, and then to see to it that they did the work intrusted to them; that as reputable machinists and skillful workmen they adopted a plan for the repairs and carried it out. . . .

"As a matter of evidence, we do not think that the mere report of the insurance company was conclusive that its inspectors had made a proper inspection of the boiler. The report is not accompanied by any deposition as to the fact or extent of the examination, or as to the competency of those who made it; and while the fact that defendant received it was some evidence of care on its part, the weight it ought to have in determining care is for the jury. No manufacturer can turn over the supervision of his boilers and machinery to an insurance company, and thereby exempt himself from the penalty of negligence by their mere report to him that the boiler is in safe condition. He must go further and prove that the insurance company's inspectors were competent, that that they did properly inspect and truthfully report, if he invokes the full weight of the act in his favor on the question of due care."

56 Atl. Rep., 345.

Draftsmen's Scales and Section Liners.

BY LEWIS F. LYNE.

"This is a faithful saying and worthy of all acceptation"—that during the past thirty-five or forty years there have been few or no improvements in draftsmen's scales or rules for measuring drawings.

The original and customary flat boxwood rule or scale with beveled edges has

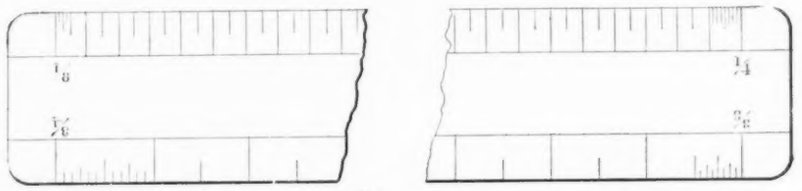


FIG. 1

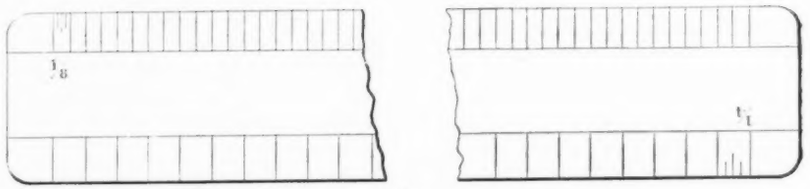


FIG. 2

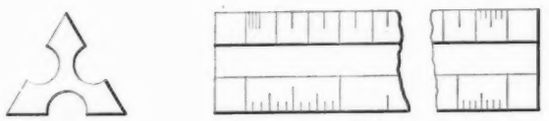


FIG. 3

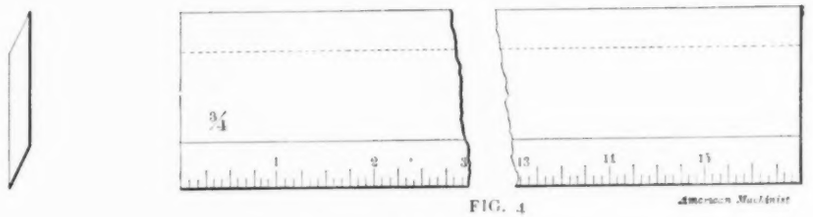


FIG. 4

DRAFTSMEN'S SCALES.

usually ⅛ and ¼ inch per foot upon one edge, ⅜ and ¾ inch on the second edge, ½ and 1 inch on the third edge, and 1½ and 3 inches on the fourth edge. Referring to Fig. 1, the ⅛-inch scale begins ¼ inch from the left-hand end and extends from left to right while the ¼-inch scale begins ¼ inch from the right-hand end and extends from right to left. It will be observed that the divisions cross one another and that it is a very easy matter for a draftsman to get confused with these two scales on one and the same edge of the same implement. I have seen others get all mixed up and have been mixed up myself by these scales that cross one another.

I do not know why the marks upon these scales begin ¼ inch from the ends and have often asked this question from older and more experienced men. The best answer I have received was that they were first made that way and the original plan had always been kept up. I believe it is about time to make a change. So long as draftsmen continue to buy old and faulty implements the manufacturers will make them. There is no doubt about that. Several years since I had four scales made to order. They were 12¾ inches long, 1 5-16 inches wide, had a strip of white celluloid ⅜ inch wide upon each edge, and were graduated as shown in Fig. 2.

It will be observed that there is only one scale upon each edge—that is to say, the ⅛-inch scale extends the entire length from left to right and the ¼-inch scale also extends the whole length from right to left. As there are but two scales upon this rule, it is impossible for one to get mixed up with conflicting scales when using it. The second rule has a ⅜-inch scale upon one edge and ¾ inch upon the other, the third has a ½-inch scale upon one edge and 1 inch upon the other, and the fourth rule has a 1½-inch scale

upon one edge and 3 inch upon the other, and the reader will understand that we have in the arrangement of these scales overcome a part of the objections alluded to in the beginning. But the graduations upon all these rules begin ⅜-inch from the ends, hence in setting off measurements with the pencil one is liable to commit an error, but for transferring dimensions with the spacing dividers these scales are all right.

A friend of mine (or at least I have always considered him as one) presented me with a 24-inch triangular scale shown in Fig. 3 when they first came out, and since then I have never arrived at a satisfactory conclusion as to whether he really intended to do me a service or whether it was meant as a joke. I have a strong conviction, however, that he purchased this scale and, after experimenting with it himself and perhaps *finding* his temper ruffled by it, he turned it over to me to see what effect it would have upon my general good disposition. My first experience with this rule was not at all satisfactory. After placing my paper upon the drawing board and deciding upon the scale, I picked up this triangular rule, examined it, rolled it over, turned it end for end, and rolled it over again until I found the right scale. The first measurement was then laid down upon the board and the rule was again manipulated as before until the right scale was found, when the second measurement was laid down upon the drawing.

There is a clamp made that may be put upon this rule to aid one in finding the right scale, but this device is seldom used by draftsmen, who generally go on a hunt for the particular scale wanted. If a draftsman has a caller, that individual will generally pick up the rule and put it down in some other position from that in which he found it, all of which leads the owner to say cuss words, and in his excitement to make more or less mistakes. After about one hour's experience I laid my new triangular rule away and have not tried it since.

Some people, I believe, are in love with these triangular rules and could not be persuaded to use anything else, but I cannot understand how any ordinary draftsman can avoid getting mixed up with the conflicting figures upon this rule, more particularly the ⅛- and ¼-inch scales, which cross one another as described.

I consider the rule represented in Fig. 4 free of the faults pointed out as inherent to all of the foregoing rules and scales. These rules are exactly 12 inches long, 1⅜ inches wide, 5-32 inch thick, of boxwood and with a facing of white celluloid upon each edge. Both edges are graduated alike and these graduations extend right up to the ends of the rule. No matter how this rule drops upon the board, the workman in picking it up *may* have to change ends with it, but that is all; he can never get mixed up with any other scale than the one he is using. To be sure, two scales might be put upon each rule, one upon each edge, as in Fig. 2, but I do not recommend it. A set of these rules will last a man almost a lifetime, and therefore it pays to get the best and have them right. The ends should be faced with brass, but this is not imperative. By an examination of Fig. 5 one may readily see how easily these rules may be handled in marking off distances either from the T-square or from the triangle or set-square, by placing the end of the rule against either one, and at once with a needle-pointed pencil mark off the distance required, precisely as is done with a 2-foot rule or a steel measure.

I have had a set of these rules in use for a long time, and thus far have failed to find any fault with them. A friend saw them and fell in love with the principle and immediately ordered one set of four. He would not now do without them. After the first few hours' work one begins to discover their advantages and develops an attachment for them.

The subject of section liners has had its share of attention in my experience, and I have them costing all the way from $1.50 to $16, but do not now use any of these intricate appliances. I do not now remember how the idea was suggested, but many years ago I made, out of a piece of tin, the simple device shown in Fig. 6, and slipped it under the screw of one of my drawing pens. The idea is so simple that it hardly requires any description, but for the sake of the students and beginners I will describe this most rational of all section liners.

Referring to Fig. 6, the reader will observe that it is merely a piece of tin with a slot *D* in the side to slip under the head of the screw for adjusting the blades of the drawing pen as shown at *B*. The end of this piece of tin is slightly bent outward to any distance *A*, which represents the space between the lines to be drawn or shown in section. It is surprising how accurately lines can be drawn by means of this simple and inexpensive gage.

I have during the past few years shown this to many draftsmen, students and professors, who have all evidently appreciated it, as all their comments were profusely in favor of this little device. I have also brought it to the attention of one of our leading manufacturers of drawing instruments, who expressed his admiration of it and gave the impression that he would soon make some and place them on sale. I hope he will, because every person who sees mine wants one, and I, of course, have to oblige my friends.

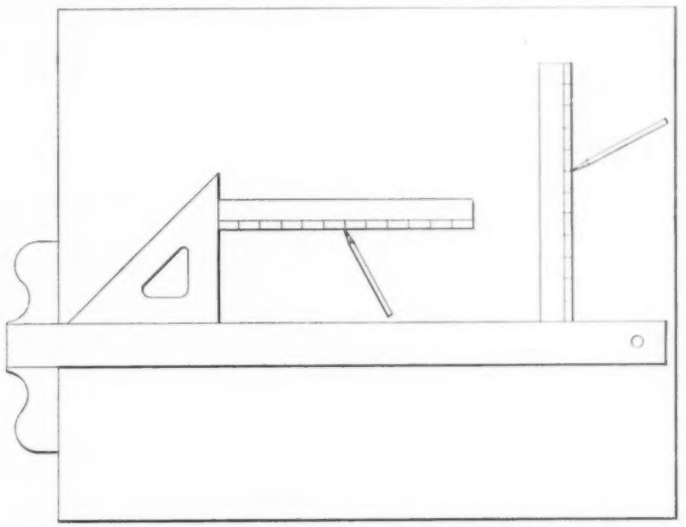


FIG. 5 USE OF SCALE SHOWN IN FIG. 4

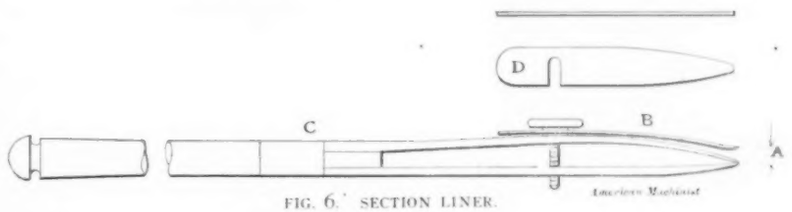


FIG. 6. SECTION LINER.

To indicate when the moving parts of machinery, or parts in frictional contact with those in motion, have become excessively heated, a German inventor has devised a paint composed of an amalgam of the iodides of mercury and copper, which the inventor claims will change color when heated. Bearings to which it is applied are red under normal conditions, but when a temperature of 140 degrees Fahr. has been reached the paint becomes black. Lobster colors turn just the other way.

Letters From Practical Men.

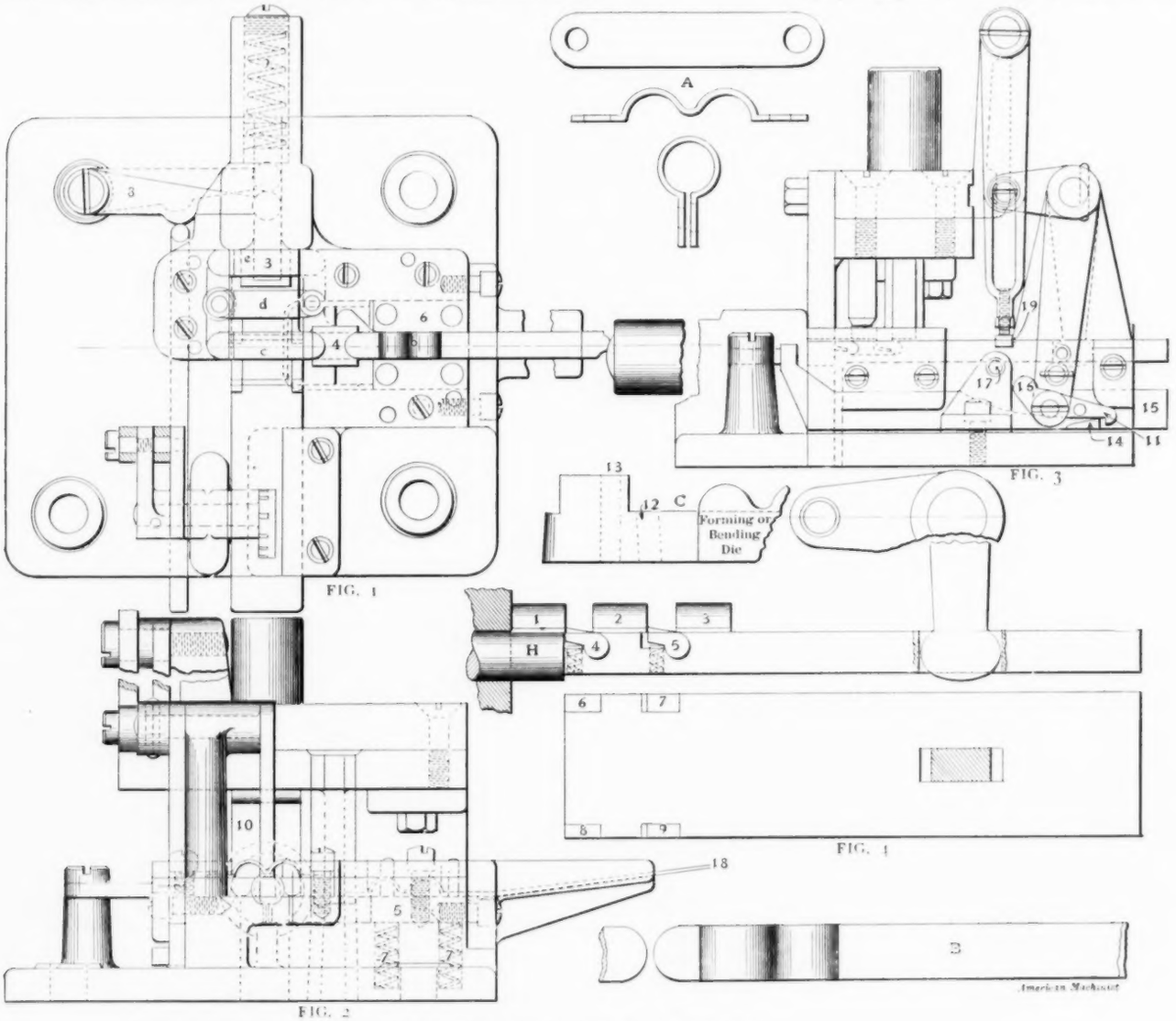
Dies for Making Copper Clips

Editor American Machinist:

At page 1743, Vol. 26, Mr. J. C., of Rugby, England, shows a set of dies for forming a copper clip. He shows two dies for three operations, which do not include the cutting off, and his clips also have no holes punched in the ends.

I offer herewith a few sketches of an automatic push-feed die for making a metal clip complete in one press-stroke. At *A* is shown the blank, its shape after the first operation and the finished clip. It has a hole punched in each end, one for tapping and the other for clearance.

This die automatically performs four operations, and after the third stroke a complete clip is made every time. The stock is fed from a reel by hand. At *B* is shown a piece of the stock after the first stroke of the press, having the semicircular end trimmed and the first bend made, which is done when in position *b*, Fig. 1. The stock is carried to position *c* against the stop-gage, when the second stroke is given, cutting or trimming the other end. On the return movement of this second stroke the blank which was cut off is removed by the push-feed to position *d*, where it has the two holes punched in. On the return stroke the blank is removed to position *e*. At the next or fourth stroke the blank is closed around the arbor 3. The arbor is then withdrawn, stripping or releasing the completed clip and allowing it to drop through a tube, not shown, to separate the finished article from the scrap.



DIE FOR MAKING COPPER CLIPS COMPLETE.

Fig. 1 is a plan or general layout of the die, a cast-iron holder or frame carrying the working parts. The stop-gage, with stripper and gage 6, keeps the blanks central and strips the blank when at *d* from the two hole-punches. 4 is the cutting-off or trimming die. This die is shown enlarged at *C*, showing the two cutting edges. This difference in hight of the two cutting edges is a very essential feature. The punch at 13 cuts off the blank at *C*, and while descending beyond that the blank is bent, allowing the metal to be drawn in from both ends equally, and then the cutting punch trims the end at cutting edge 12. The bending die 5, Fig. 2, is then brought up to the hight of cutting edge 13 by the four springs 7, Fig. 2, and the stock can then be easily moved along.

The arbor 3, Fig. 1, is connected to the lever 8 (shown in two positions), and is brought back in place by the spring 9. This takes place as soon as the closing punch 10, Fig. 2, leaves the metal. The movement is obtained by pawl 11, Fig. 3, taking hold of the projection 14 on slide 15, pushing lever 8, Fig. 1, back to the dotted position; then, as the clip is released and drops off, the boss 16 and pawl 11 release the slide 15 by the former striking the pin 17. The arbor and slide are then moved back in position by spring 9, Fig. 1.

Fig. 2 shows the front of the die complete, with the punch entered and a piece of the stock 18 in the die.

Fig. 3 is the left-hand end view of the die and punch complete, showing the movements for the push feed and the slide for stripping the clips from the arbor. The

screw 19 is for the adjustment of the push feed, to bring the blank central with the hole-punching dies, thus taking up all wear from the working parts.

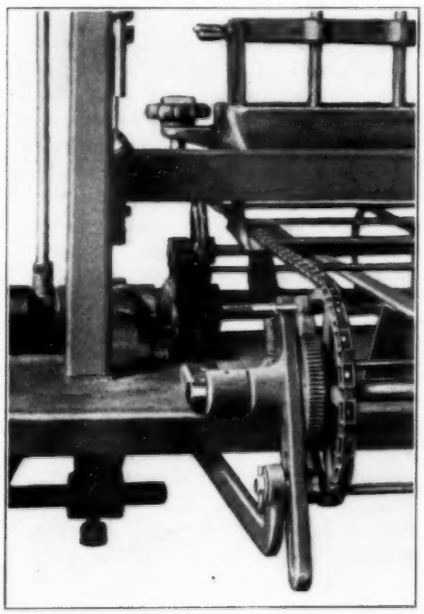
Fig. 4 shows two views of the push feed and a section of the closing arbor *H* with the blanks 1, 2 and 3 in position and the four carrying pawls 4 and 5. These pawls have a very soft helical spring under each, just strong enough to lift them up in position after they have passed back under the blanks. All four of these are shown at 6, 7, 8 and 9 in the plan view.

JACK MARKS.

An Intermittent Reciprocating Movement From a Crank.

Editor American Machinist:

I send you sketch and photograph of a crank-actuated intermittent movement for which a cam would generally be used, but there was not room for a cam large enough for the required throw. When the crank pin contacts on either projecting lug on the long slotted connection, the latter is moved until the crank pin leaves that lug; all is then stationary until the crank pin contacts with the other lug, which moves the lever in the opposite direction, where it again rests. It is obvious that, with a crank of fixed throw, the movement may be varied by moving the lugs towards or away from the center of the shaft, and of course the pauses between movements will be longer with a shorter throw. This device is entirely practical



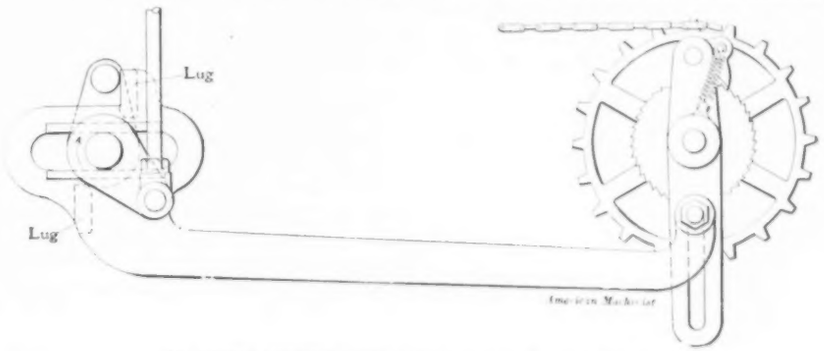
THE INTERMITTENT FEED AS APPLIED.

at 60 revolutions per minute, but would not do at much higher speeds. It was used for an intermittent chain feed which had to stop at each stroke of the machine. It was necessary to vary the amount of feed for different material, which was done by the upright, slotted, oscillating lever. The movement of the feed was timed by changing the position of the crank around the main shaft. While this arrangement may not have been new, it was original with me. J. L. GARD.

Laboratory versus Shop.

Editor American Machinist:

The question of whether or not the place in which instruction is given in the mechanical arts should be called a laboratory or a shop is not altogether a question of the dignity of the term "shop," as implied in the letter by Mr. M. P. Higgins at page 1200, Vol. 26, and since discussed in various communications to the AMERICAN MACHINIST, but is rather one of facts. An article by Mr. R. H. Smith on the same subject, at page 74 of the current volume throws new light on the question, but a different point of view is still possible.



AN INTERMITTENT FEED MOVEMENT FROM A CRANK.

In a general way, the word "shop" means construction and sales, while laboratory means investigation and reports. A technical school, therefore, can have no real shop under this definition unless it has a place in which some commercial work is going on. Hence it would seem right and proper that the Massachusetts Institute of Technology should substitute the term machine tool laboratory for machine shop.

We have, however, at the Worcester Polytechnic Institute another proposition—a real shop running on a commercial basis and known as the Washburn Shops. Its products are known all over the world, and its designs are copied by manufacturers in this and foreign countries. The leading machine-tool houses act as our selling agents in all of the large cities here and abroad, while repeated orders testify to the workmanship and value of what has been put upon the market. A large correspondence and the many calls from representatives of the large machine and supply houses keep us in touch with the very latest developments and market prices.

Of what benefit is all of this to the student? He receives instruction in a commercial shop; the product of his hands may be, and often is, made use of in the regular work. He has an opportunity of learning something of the innate depravity of inanimate matter, an asset of practical experience. He breathes a little of the commercial atmosphere, sees raw material coming in and finished product going out, and, while not learning to be a mechanic himself, he has an opportunity of learning something of what journeymen can do and how they do it, and all of this while he is still active in the classroom and free to ask questions of his instructors there and investigate for himself in the various laboratories of the Institute.

What can the shop do for its part in a young man's training? If he is to be a mechanical engineer, he can learn in the various shops how things are done—that is, if the shops and laboratories are run on an engineering basis. In a trades school the young man learns how to do certain things; in a manual training school, something of the art; in an engineering school, of matter; not simply how to handle it or how to make it graceful, but all about it.

If the shops offer what they should and the student makes the most of his opportunity, then the young engineer, although not an expert draftsman, sees a design in a drawing; not a patternmaker, yet sees a pattern; not a molder, but sees the pattern coming out of the sand; not a machinist, but has a vision of how the piece is to be held on the planer and centered in the lathe; not an operator, but sees where the operator will stand and where the governing levers will be handy; not a business man, but knows how much it will cost for material and labor; not a salesman, but has a knowledge of the advantages of this machine and the disadvantages of the other man's.

A shop where business is going on, where pay-rolls are made out, where inventories are taken and where shop costs are known, must offer a wider field for observation and training than a shop where the students alone are at work.

This is why the Worcester Polytechnic Institute carries on a commercial business in the Washburn shops—not to teach the students a trade, not to make money by their labor, but rather to furnish a working shop where students without engineering abilities may develop and lay the foundations for future engineers.

Worcester, Mass. W. W. BIRD,
Professor Mechanical Engineering, Director Washburn Shops.

Oil and Emery for a Slide Valve.

Editor American Machinist:

I would suggest that all the old-time machinists and engineers whose experience dates back before the war give some reminiscences of past observations. I am prompted to make this request by reading the recital of Mr. Charles T. Porter, whose experience has been so extensive and so valuable to young as well as old-timers.

A little bit of engineering experience came under my notice in Pittsburgh before the war. A new engine was built for Shoenberger's nail factory, an oscillating engine of about 30-inch cylinder with a stationary slide valve enclosed in a steam chest. This engine when erected refused to do the work, and after all expedients had been tried it was found that the slide valve being of a curved shape expanded out of straight when heated. It was an uncertain proposition to try to place it so as to be straight when hot, and as the engine was no good otherwise, the engineer, Mr. Tom Harris, suggested oil and fine emery in large doses, which he administered for several days, running idle, after which it was found to be entirely steam tight. This would be considered a dangerous experiment now, but it worked, and the engine continued to drive the largest nail factory in America for many years. C. W. CRAWFORD.

A Peculiar Straight-Edge Experience.

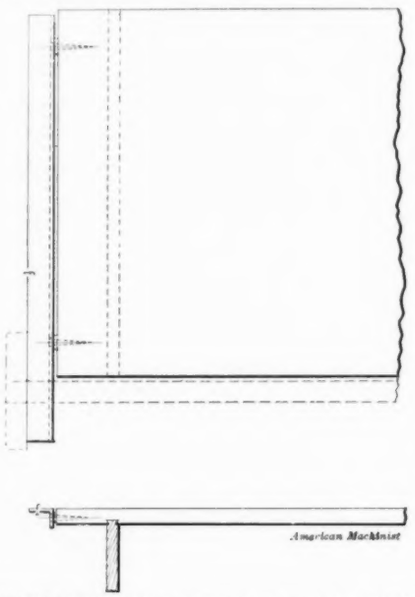
Editor American Machinist:

Mr. Shaw's article, at page 1264, Vol. 26, on the making of surface plates, we all read carefully; and now I want to give my little experience with a surface plate and a straight-edge.

A firm with which I was connected for several years, building general automatic machinery, decided to build, for the trade, machine tools. The machine tools in our shops were old and well worn; and with no better ones in sight, I started getting out the parts as best I could.

We ordered from a well-known maker an 18x18-inch surface plate and an 8-foot straight-edge; by the time they arrived some of the parts were machined, and, being anxious to know the condition of some of the castings which had been planed, we tried several with the 8-foot straight-edge. Some short surfaces showed up pretty fair, though none of them showed right with the straight-edge, and they were all out the same way. Some of them could have been sprung in the planing.

We were at this time planing a very particular casting, which weighed about 3 tons. When it was finished we tried it with the straight-edge and found it a good job. I afterwards told a man to rough scrape a surface on it, which was about 12 inches wide and 8 feet long, and to use the surface plate so as not to get holes in it. After he had scraped out the tool marks we tried the straight-edge on it. There was a space in the center between the work and straight-edge which at first looked large enough for the pay-master to shove a fellow's pay through. I doubled a time sheet and put it between; this was 0.005 inch. I looked at the man. Second thought convinced me it was my own fault. I should have tried the piece before he cut the heart out of it. In any event he could move a whole lot of metal in a short time. I examined the work and straight-edge, thinking a burr or dirt had fooled us; but no, there was the same opening. I thought it over that night and decided it would be best to replane the casting. The following morning I was explaining the job to the planer man, telling him to set it up so that the tool would just touch the ends and favor it all he could. Another last look to show him what was wanted—and the straight-edge showed just the opposite from what it had the night before: it was bearing heavily in the center and one could look through



INCREASING THE CAPACITY OF THE DRAWING BOARD.

under both ends. It was the month of July; the days were very warm and the evenings cool. What did we do? We just left the straight-edge and casting to fight it out between themselves, and after twenty-four hours' fighting, which was watched by several, the casting was given the decision, as it was in better shape at the finish. We afterwards put the piece back on the planer, only to take it off again, as it showed up as good as when it was planed. We were guided by the tool marks in scraping this piece, and in testing the machine the work was satisfactory. The surface in question was the bearing for a slide which carried a tool, and any inaccuracy would be duplicated in the work done by it.

I have seen used in several shops strips of cast iron with dimensions something like ¾x3″x6′ long; and a planer hand who would be guilty of planing work so badly that the last-named straight-edge would not make it all right (whether it was or not) should be forced to work at bricklaying or some other less particular straight-edge job. FRANCIS T. GRIMES.

Increasing the Capacity of the Drawing Board.

Editor American Machinist:

Enclosed is a sketch of a device we use in our drafting department which will be found very useful to anyone who wishes to work close to the edge of his drawing-board. It consists of a piece of light angle iron of suitable length planed on top and one edge, as indicated, fastened to the board with two wood screws and held out from the board a little by two small washers. The lower end is made to extend any desired length beyond the edge of the board. This device insures accurate drawings at all points of the board and permits the draftsman to work closer to the lower edge. W. E. M.

Classifying Non-Productive Labor—The Human Equation.

Editor American Machinist:

The system for obtaining cost and distribution of non-productive labor, explained by Mr. Geo. R. Pearce at page 181, no doubt secures the results aimed at, and therefore, as he says, is worth what it costs, and much more, but it has grave defects.

Instead of devising a special system of cost keeping for repairs and running expenses, all expenditures of time and material, for power, light, heat, supplies, etc., should be classified *every day*, and be charged to their respective jobs or accounts, which latter can be divided into as many departments as required. Each workman should account for his full time every day, and if each job is numbered, this is easy. For instance, general labor, cleaning, oiling, etc., could be called No. 5 and repairs to steam heat plant No. 67 or any other number, which need never change. It is a mistake to put plant additions under a general heading. Such additions, if real, should be treated as *productive*, and be added to the inventory, each new addition being made on a separate job number.

Mr. Pearce's idea of marking non-productive jobs with a cross is all right, although even this is obviated by us, in the following way:

All work which we make repeatedly, including various expense accounts, has permanent numbers which never change. We do considerable repairing and many odd jobs, millwright work, etc., and we take care of these jobs, numerically of course, on what we first called B tickets to distinguish them from those used for stock work, which we called A tickets. Our B tickets are temporary only, and all record of them is destroyed after, say, two years. We soon found that, although the A and B tickets started even, numerically, the B class soon ran so far ahead that the number alone indicated the class. The A ticket

numbers grew comparatively slowly, being permanent, while the B numbers would grow at the rate of over 1,000 per year. We no longer keep the A and B distinction, although we had a little struggle about abandoning it. We know, for instance, that all ticket numbers over 5,000 are temporary, and each year they get higher. As the records are destroyed after two years, there is no possibility of confusing the permanent and temporary records.

I mention this to show that the temporary job cards can be used whenever it is required to find out the cost of any certain change, which, when ascertained can be transferred to its general heading. For instance, moving a boiler or engine would be an expensive job properly charged to shop expense, but yet one would like to know just what it did cost.

The proper distribution of expenditures should be made naturally, and at the time, by the one in charge who orders the work done. He knows, and he is the one to decide, to what each item is properly chargeable, and without any red tape.

This brings me to your editorial comment on "Equipment and Competence" at page 233. Equipment, machines and systems are only tools. The finest tool in the land will do poor work unless the man behind it uses good judgment and skill. The best system of cost keeping will be futile unless intelligent application of it is made. The human equation cannot be overlooked. All attempts to reduce men to machines are failures. No two men are alike. I am rash enough to say that strikes and other labor troubles are largely caused by modern methods of specialization, and classifying men in groups, as lathemen, drill-press hands, etc. If you group men you give them a common interest and they make common cause. If all men were treated differently they would not have common cause for revolt. I do not mean by this to advocate a free and easy shop. Colonel Pope has been a very large employer of men, and I believe a successful one, in the best sense, particularly in the respect that strikes have not troubled him, and yet he claims that he treated each man according to his deserts. Trying to substitute plans, systems, and rules for intelligent supervision is not, and never has been, a permanent success.

No matter how large the business, if we follow down the line, we will find that each man knows the man under him, from the president down to the sub-foreman. If more attempts were made to apply this knowledge, with a view to getting out good work and lots of it, the results would be surprising. It seems to account for the phenomenal success of some concerns who lack perhaps equipment and capital to start with.

The advocates of the various premium plans are at loggerheads, as soon as they begin to compare their plans *on paper*. Under favorable conditions, each one would no doubt show good results in practice, because each advocate would use his own plan intelligently.

If each workman were watched and the results of his work made known, his pay could be and is graded accordingly in shops run by intelligent men, who keep in touch with their workmen, and the men soon learn this. Personally, I use the premium plan, when I can, as an incentive. It does help, as any plan will, that enables a workman to earn a little more by making an effort.

ROBERT J. HEARNE.

An Arc Planing Rig.

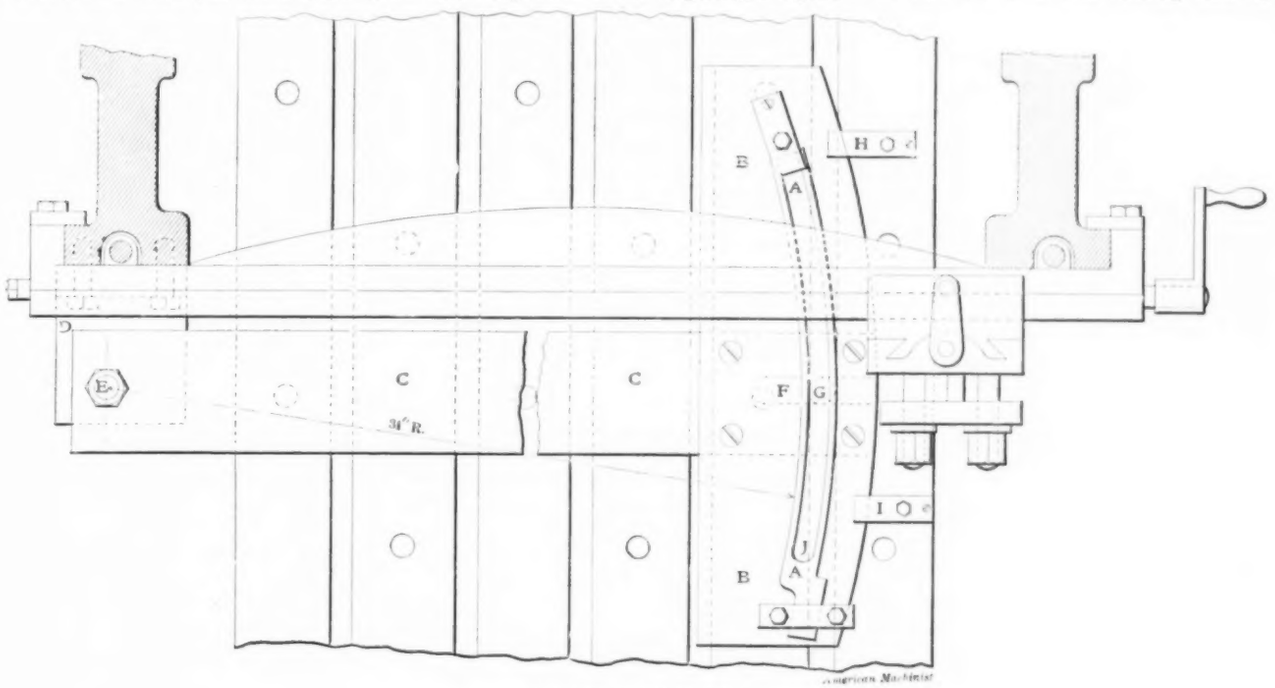
Editor American Machinist:

Referring to the arc milling rig shown at page 46, we have a different and I believe a better way of doing the job.

Referring to the sketch, the arc *A* was fastened to *B*, which in turn was fitted to a radius bar *C*, somewhat longer than the radius of the arc to be planed. An angle plate *D* was fastened to the planer housing below the cross-slide, and supported the fulcrum pin *E* of the radius bar. A slot *F* was milled on the lower side of the radius bar to receive a stud *G* which was fastened to the planer table. Two clamps *H* and *I* were put on the planer table, to give the swinging arm some friction, and a hole was drilled at *T* to give clearance for the tool.

The job was done with this rig in about one-half the time that milling had required. Any arc of considerable radius may be planed in this way, provided a solid support for the fulcrum pin can be found in right relation to the travel of the planer table.

G. F.



AN ARC PLANING RIG.

Correcting Blueprints.

Editor American Machinist:

Your correspondent, E. S. C., at page 123, evidently forgot to tell a part of his story, so with your kind permission I will attempt to supply the omission.

By applying the erasing fluid before making the correction he not only gets a white spot to mark on, but destroys the sized surface of the paper, so that the black ink used produces woolly marks that look like writing done on blotting paper.

By the way, lines omitted on a tracing can often be produced on the blueprint by scratching through the blue surface with a sharp-pointed knife. If carefully done

the resulting line is much better than one made with erasing fluid.

I feel rather guilty in using the last two words, as the stuff is not used for erasing at all. If the dealer called it correcting fluid, or corrective, or something of the kind, it would be more sensible.

Some blueprints I recently sent the editor had several lines produced by scratching with a knife, and I feel quite confident that this fact passed quite unnoticed. Had these lines been put in with the fluid they would have been detected at a glance.

L. O. DANSE.

Actual Work of High-Speed Steels.

Editor American Machinist:

I would be pleased to have a few inches of space to reply to Mr. D. E. Norris (page 228). The letter referred to is beyond my comprehension. I cannot understand what is meant by a shop owner who does not care for high-speed steel. There is as much difference between high-speed steels of to-day and tool steels of five to ten years ago as there is between up-to-date motor-driven tools and tools that were built thirty years ago, and were it not for the high-speed steels the improvement of up-to-date machine tools would not be a necessity. It is impossible for an up-to-date factory to keep up with the times without the use of high-speed steel.

I would like to tell of some of my experiences in the last three years. I was general foreman of a large factory here in Worcester for a year and a half when they had some sheave wheels for wire rope to run over. The faces varied from 3 to 7 inches, with a diameter from 25 to 72 inches. When I first went to the factory they had tools made of all kinds of steel, including Mushet, which was the best at that time, and the time consumed in machining one of these wheels was from 9 to 15 hours. After looking the matter up for a few weeks I came to the conclusion that the tools were not what they should be, and I had the blacksmith re-dress all the tools and make some new ones, and I gave the job another trial, but the tools would not stand up under any more feed or speed, and a second trial was no better. I ordered two kinds of high-speed steel and gave the sheave wheel another trial. With this the time was reduced to from 4 to 7 hours, the feed was increased threefold and the speed from 25 to 60 feet a minute. I have known the man to rough and finish three wheels without regrinding the tools.

This test was but one of many where the same results were obtained. There is one firm here in Worcester using 1 1-16 inch high-speed twist drills that will drill 300 holes through 3½ inches of grey iron without regrinding, the speed and feed being from 30 to 60 per cent. higher than can be used with the ordinary twist drills.

Since I was appointed superintendent of the plant where I am now (which is one of the largest in the country) I have made a number of tests with the high-speed steel on machine steel. We had some long bars to turn from 5½ inches to 3½ inches and we used high-speed steel for this job. The man turned two bars of 5½-inch machine steel (of .015 carbon) down to 3½ inches, 8 feet long, without grinding the tools, at a speed of 48 feet and a feed of ⅛-inch with a chip of ⅝ inch on the diameter or 5-16 inch on each side, and this was done with a single tool.

At another time I had some cast cylinders of the metal known as semi-steel to bore to 18 inches inside diameter by 12 feet 2 inches long. When the castings were brought to the factory I found there was 2 inches to bore out, so I made a boring bar 9 inches diameter by 15 feet long with a sliding head, and put the bar on the lathe centers while the cylinder was bolted securely to the bed. Then I put six ¾-inch round high-speed steel tools into the traveling head and bored the cylinder from 15¾ to 17¾ inches from end to end, a distance of 12 feet 2 inches, at a speed of 25 feet and with feed of 5-32 inch. The first three tools had to cut on scale, because the core was out about ½ inch in the length of the cylinder. The tools were not worn on the points to any great extent, and the finishing tools bored the three cylinders at a speed of 30 feet with a feed of .2 inch without being reground, so I think if our friend Mr. D. E. Norris will take the trouble to look up the high-speed steel he will find a vast difference in his factory production. A good blacksmith can forge a high-speed steel tool just as quickly as any other steel, and it can be ground in less time.

W. A. WATERMAN.

Worcester, Mass.

Getting out Broken Studs.

Editor American Machinist:

A writer in *Power*, February issue, advises against the use of a square drift for removing broken-off studs because, as he says, after drilling out the inner stock and thereby relieving the tension, driving in that square drift will press the threads together tighter than they were at first, making the success of the operation doubtful. A left-handed flat drill is then recommended.

I believe the writer's experience with a square drift is a very common one and therefore I would show how I tackle a broken-off stud, say, ¾ inch. First I hunt for or make a *straight* piece of square tool steel of such a size that it will measure over the corners a little less than the tap drill for that size. As 7-16 inch square measures scant ⅝ inch over the corners, it will do. Drill the hole 1-64 inch smaller than this size. Grind one end square and then temper that *straight* piece of tool steel and draw to a blue all over. It is then at its best to stand torsion and hard enough to cut the four little grooves, each one-half of 1-64 inch deep, away through the hole in the stud without expanding the same. Now apply a tap wrench or whatever tool is handy.

It may seem that the hole was drilled too big and that the drift would turn without taking the stud along. In order to do this, that drift would have to act as a square reamer, enlarging the hole at the rate of 1-64 inch per quarter of a turn, or 1-16 inch per each turn. Anybody who ever reamed holes with a square reamer, such as taper pin-holes, knows how little it takes to make that reamer stick to the breaking point, and how many more than one turn it takes to enlarge a hole to the amount of 1-16 inch. J. SCHURING.

Milwaukee.

Combined Drawing and Black Board.

Editor American Machinist:

Perhaps some of your readers who have a drawing board attached to the wall at home will appreciate the following suggestion regarding it:

I have one which is 3x4 feet with a detachable stick for holding it in position

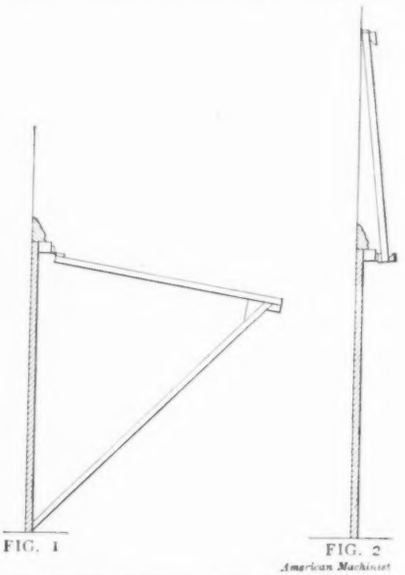


FIG. 1 FIG. 2

American Machinist

COMBINED DRAWING AND BLACK BOARD.

when drawing. A short time ago when I decided to give drawing lessons the first article needed that suggested itself was a blackboard, and it occurred to me that the drawing board could be used for that purpose also. I rearranged the hinges and placed them as shown in Fig. 1, so that by raising the board parallel with the wall the under side could be used as suggested.

I applied two coats of blackboard paint, placed a hook at the top of the board to hold it against the wall, and placed a strip of wood at the bottom to hold the chalk. The board is shown in position for use as a blackboard in Fig. 2. "Compo" board tacked on would be better if one cared to go to the expense of the same, but the paint makes a very satisfactory surface and answers the purpose. C. E. J.

A Tool Dresser and High-Speed Steel.

Editor American Machinist:

I read with much interest Mr. D. E. Norris's comments on high-speed steel, at page 228, and as he seems to have trouble in making it "go," or his tool smith doesn't "catch on" to the proper working, I thought for his benefit, and perhaps that of some other of your readers, I would tell my experience in this line, having had to do with steel tools of all kinds and steel of all brands for the past twenty years, and being accounted an expert on general tool work.

I am at present employed in a shop where the piece-work system is used exclusively, and the material worked is steel rails of every degree of hardness and the cuts taken on the planers (double head) are of such depth and with such feeds as to cause the vibration to be felt a block away. Would this be possible with the old reliable? Further, all holes are drilled and a great many drills are used, and before I came here all drills were made of tool steel, and each man (there were about twenty-five of them) would have from eight to sixteen drills to dress and temper in ten hours. This meant about one drill for twenty holes, when it would be worn too small for further use or the point would be burned off. So it can be realized that I had to hurry constantly or do something to help matters out.

As there was quite a lot of air-hardening Novo, high-speed steel (the kind used here) scrap around the shop, I gathered it up and made lip drills from it as opportunity offered, and finally I had for each of the boys a couple of drills of the size most in use. Results: the smallest number of holes drilled, 82; greatest number drilled, 3,236. This latter drill was used nearly four weeks constantly, but an exceptionally good man was on the machine. He reports that he does just one-fourth more work with these drills than with those of tool steel, and the difference between 82 and 20 holes speaks for itself. Where formerly yours truly had to dress from 80 to 200 drills per day, from 20 to 50 are the figures now.

Do I have any failures? Sure thing; but only about 1 in 100; with the result that those I am doing work for are better satisfied, and I do less work, with better results than were possible before.

The planer tools and drills are generally ground in the morning and at noon, except where exceptionally hard rails are encountered, when more grinding has to be done; but this is an exception.

Now, the way this steel is worked to get these results is, I think, the secret of its success, and of course its uniformity, as I have never heard a "kick," except once or twice. It is not necessary to burn the point off to get it hard, and not necessary to make a new fire or change it to get the best results. Simply use plenty of fuel, get a good, white heat and put on a strong blast, the stronger the better for a hard point, or cool the point in cold linseed oil *until cold* and cool the rest of the tool off in the air. This gives a moderately hard cutting edge.

As to the time consumed in working and tempering, I can say that I would sooner dress half a dozen tools of this brand than one of tool steel, because you can't burn it in an ordinary smith's fire. It is as easily worked as tool steel (as long as it is worked hot), and the tempering is simply a movement of transferring it from the fire to the air blast for a hard cutting point, throwing down after forging for ordinary work, and, if still too hard, sticking the hot point in the ashes until cold, and it will be as tough as any tool that was ever made.

Of course it is possible to break these tools as well as any others, but when the claim is made for them that they will do 50 per cent. more work than tool steel, that is no reason that they should be expected to do the impossible and then kick if they break down. I know in our shop there are few broken tools, and when a machine is pushed past the limit, it is generally some part of the machine that breaks, instead of the tools of the high-speed steel which we use here.

THOS. BEASLEY.

Believe in High-Speed Steel.

Editor American Machinist:

We take exception to a letter from D. E. Norris, Tiona, Pa., published at page 228, in which he finds all sorts of fault with high-speed steel, claiming, among other things, that it gives great trouble by breaking at the tool-post.

Mr. Norris must have been very unfortunate in his selection of steel. We have seen, within a week, a tool made of a certain high-speed steel forged from a bar 2x1½ inches, which, through the hard service the tool was put to, bent at the tool-post ⅜ inch out of a straight line. This shows a degree of toughness which surpasses anything which could be expected from any of the regular carbon steels or the old self-hardening steel.

The great trouble with many persons using high-speed steels is that they do not increase the size of the tool in proportion to the amount of work they do with it. They have been in the habit of using a carbon or a self-hardening steel, say, 1½x ¾ inch. They order a bar of high-speed steel of the same size and condemn the steel if the tool breaks. They are putting four or five times the strain on the tool that they formerly did with the carbon or old-fashioned self-hardening steel, and fail to make provision for this by an increase in the size of the tool.

It is necessary in the use of high-speed steel to use ordinary judgment and common sense, as it is in any other details of shop practice.

There was a time when the superintendents of some of the largest plants in the Pittsburg district did not see the value of high-speed steel, but we think now that three-fourths of the larger firms in this district have adopted high-speed steel with remarkable success, and the matter of breakage with it is a thing of the past.

Anyone who has kept abreast of the times and has a fairly good tool-smith cannot help but appreciate the value of the new steel. Mr. Norris also makes the claim that high-speed steel is hard to forge and temper. We do not see how anyone could make this claim, as in making tools and conducting tests we have not met a smith who does not remark that it forges easily.

The tempering of the tool is the easy part of it, as after the smith has given it the high heat which is just short of injuring the cutting edge, you have a sure thing that the tool is tempered properly, having no guesswork as with the other grades of steel.

McKENNA BROS. BRASS CO.
Pittsburg. C. H. McKENNA.

[We have published a good deal in favor of high-speed steel, and of course believe in it. Our columns, however, are open for the proper expression of opinion on this as on any other matter pertaining to machine shop practice, and under that rule Mr. Norris was fully entitled to give his experience. Concerning the necessity for using larger sections of high-speed steel because putting four or five times the strain on the tool as compared with the carbon, it would seem that Mr. Norris did just the opposite, because he states that though he could not run as fast with his carbon steel, he fed faster and took deeper cuts, and so he must have put the heavier strain on the carbon tools.—Ed.]

Threading Seamless Tubes.

Editor American Machinist:

A great deal of difficulty has been experienced by people who have endeavored to thread seamless tubes because of the tendency of such material to strip and tear instead of cutting easily and smoothly. In order to explain the trouble, so that it may be possible to correct it, it is necessary to bear in mind the fact that seamless tubes are made only of open-hearth steel. Not only is open-hearth steel of greater recognized value as a metal than Bessemer steel, but it is also tougher and, therefore, more tenacious in resisting any effort of the threading tools to cut it.

Common steel such as met in castings and also in merchant pipe, has a great deal more of impurities, such as phosphorus and sulphur, which tend to brittleness, than the open-hearth steel of seamless tubes, and this very brittleness is what makes it easy to thread the commoner metal.

When it is attempted to thread the tough open-hearth steel of the seamless tubes, the metal, instead of breaking away and curling off in shavings from the dies,

resists the cutting action and clogs up the dies, particles of the cuttings themselves acting as tools to cut away the portions of the threads already forming. If, then, the tools are kept particularly sharp and plenty of oil is used, the seamless tubes can be cut nicely, and if more clearance is allowed in the dies themselves, the metal can get safely away from the work instead of destroying it.

This clearance will be understood when it is advised to grind off about half the number of teeth on each die, so that instead of cutting with, say, twelve teeth, as in the old way, six only are against the tube, the space on the die formerly taken up by the other six acting as an outlet for the cuttings to escape. Sharp tools, in plenty of oil, will cut satisfactorily; then if the shavings are allowed exit through the space secured by grinding down half of the cutting teeth formerly used, good threads can be easily and quickly produced.

EDWARD SARGENT.

Gears for Variable Center Distances—Chordal Pitch.

Editor American Machinist:

It is with considerable interest that I note the criticism at page 207 of my design published at page 1712, Vol. 26, of a pair of spur gears to be run with different distances between centers. The interest is all the greater because of the fact that the design submitted as being better than mine is one which I considered and then rejected for the one previously described.

Both designs have their faults as a result of the requirements which the gears must meet. Mr. Dodge points out the fact that, because the points of the teeth of the gear are rounded off so as not to interfere with the radial flanks of the pinion teeth, just as a tooth is leaving contact there will be a slight variation in the angular velocity ratio because of the fact that only one tooth will be in contact and the point of contact will be on the portion of the gear tooth that has been slightly modified. This is true, but if Mr. Dodge will refer to my previous article he will note that it is stated that the modification does not exceed 1-64 inch. At that time the thought had not occurred that a discussion might arise over the fact that the angular velocity would be slightly affected. Since reading Mr. Dodge's article I have made a second drawing of the gears and in this took special pains in modifying the points of the gear teeth to see how much the outline would be changed and found that at the very point where the modification is the greatest it is scarcely the width of a fine pencil line, at the most not 1-100 inch, and, as everyone knows who is familiar with modifying gear teeth in this manner, the modification becomes rapidly less as the point considered is farther from the end of the tooth. In view of this fact the modification at the point of contact of the tooth in question is very small indeed.

It may be of interest to know the reason that this design was chosen in preference to the one submitted by Mr. Dodge when it was apparent that the velocity ratio of the former is not quite constant. In the first place, using the same size pitch circle, the same angle of obliquity, and the same length of tooth my tooth development differed from the one shown in the figure in connection with Mr. Dodge's article in that where his figure shows the width of the tooth at the point to be about 5-16 inch mine was only 3-32 inch. After reading his article I again developed the tooth with the same result. However, I am aware of the fact that because the cut shown in the article shows the tooth wider at the point than successive developments on my part indicates that it should be, does not indicate that Mr. Dodge has purposely "doctored" his drawing to the advantage of his design, but rather points to an engraver's error. But this does not alter the fact that, using the specifications which Mr. Dodge indicates, the tooth developed will have a point only 3-32 inch wide, which, at the time a tooth comes in contact with its mate, will be required to withstand the entire tangential force. This, in my opinion, is quite inadequate and is what led me to reject the design when the gears were called for. In my own design I considered the point of the tooth a weak part for all that they are more than twice as wide as those of the design submitted later.

There is another fact connected with the problem which was not stated in the previous article which, if it had been known to Mr. Dodge, would probably have kept him from pointing out this minute error in the design, namely, that the gears are rough cast iron. Anyone acquainted with cast-iron gearing will agree with me that I had the license to drop the thousandths of an inch on the pitch radius and to make the statement that the gears would transmit a constant velocity ratio when the distance between centers was anywhere beween 15½ and 16 inches in spite of the fact that there is a variation of a fraction of 1-100 inch in the thickness of the points of the teeth.

In regard to the matter of chordal pitch I agree with Mr. Dodge quite heartily. However, there are cases where a firm has thousands of dollars in gear patterns with chordal pitch which it would not be desirable to change. This is the case in this instance. The error due to chordal pitch as pointed out by him is very small compared with other errors in cast gears. Nevertheless it would seem that any system which introduced even small errors would have to be possessed of some good points in order to be adopted. Personally, I had supposed that convenience in spacing teeth on patterns was what brought about the system, but think that this gain is imaginary inasmuch as it is necessary to divide off the whole pitch circle with a pair of dividers to insure against any great degree of accuracy. This certainly can be accomplished as easily when the arc is an even number of inches as it can be when the chord is an even number of inches.

W. M. WILSON.

Inquiries and Sales as a Result of Advertising.

Editor American Machinist:

Referring to the article at page 196, which I have read with much interest, it would seem that my previous article, which Mr. Stritmatter comments upon, was not fully understood by him.

In the first place, I confined the whole subject to the matter of "Checking up inquiries caused by advertising" with a view to establishing which particular medium brought the greatest number of inquiries; at the same time showing a simple, yet effective, system our advertising department had adopted for ascertaining these facts.

It is Mr. Stritmatter's belief that the weak point in this system is that no provision is made to show which particular medium brings the largest percentage of sales from these inquiries. It would also appear, if I have interpreted his article correctly, that the system should have a greater scope and include data pertaining to the machines sold; contract price for advertising in each medium; system for following up inquiries, etc.

That no mention was made in my article of a way to handle these separate matters was not due to an oversight on my part, nor, in my judgment, is it a weakness of the system described. These things are quite aside from the subject under treatment, and to have described, even in a general way, a method for treating them would have required an explanation of several different and individual systems, each complete in itself.

Leaving aside, however, the system employed and touching on the value of the number of inquiries received relative to the direct sales resulting from them. There is no doubt but some periodicals produce a class of inquiries which, within a short time, would show a greater percentage of direct sales than others; but does an advertiser believe that he is going to be able, even in a small way, to ascertain simply by direct sales which periodical brings him the best returns for his money? To whom would he place the credit of the sales made to dealers? How many orders which these dealers place with him were the result of their introducing the article and how many were caused because the customer first saw an advertisement of the article itself? There is no doubt but that a certain percentage of such orders are caused from this latter reason, which being so, how is the advertiser to determine the periodical in which the advertisement was seen? Unless this information can be produced, of what value is such a system? Mr. Stritmatter admits in his arti-

cle that a paper circulated among machinists at the bench might bring indirect returns. As a matter of fact, this is not an uncommon but a very frequent occurrence and is a factor well worth considering by the advertiser.

To attempt, therefore, to judge wholly by direct sales which is the best medium to advertise in would not, in my opinion, be a safe course for the advertiser to pursue for this and other reasons.

Another feature which figures prominently with this subject is the part the advertisement itself bears towards the sale. A great mistake which many advertisers make is to expect an advertisement to perform every function connected with the sale of the article advertised and to lose faith in those mediums which produce inquiries that do not immediately result in direct orders. The fact is, when an advertisement will interest a reader sufficiently to cause him to write for prices or information, it has, in my belief, performed its purpose and the periodicals which cause the largest number of such inquiries are, other things being equal, the best mediums to employ.

The question of effecting a sale then becomes a distinct matter and one wholly for the office or salesman to handle. If the order cannot be placed, the difficulty can generally be attributed to one of the following reasons: Price too high; article inferior (or thought to be) to a competitor's; inquiry was simply to get catalog or information.

Therefore, I still maintain that the advertiser has reason for believing that his money is being spent to better advantage with those periodicals producing for him the largest number of inquiries, and the system which I described gathers this information with much less trouble and expense than any method which has yet come to my notice.

In answer to Mr. Stritmatter's inquiry as to what proportion of cards we send out are returned to us, I will say that it is an exception where one fails to come back. When such an exception occurs, we follow it up with another and never has this second request been declined. Perhaps the reason why one-third of the cards Mr. Stritmatter sent out failed to come back may have been because the response called for too much clerical work in filling in the desired information. Minimize, as far as possible, the clerical work your request calls for, and the ratio of replies will correspondingly increase.

Worcester, Mass. G. K. WILLAND.

Constant for Depth of Gear Teeth.

Editor American Machinist:

In reckoning the cutting depth of fractional pitch gears, I have found the constant 2.15708 to be a valuable one. This quantity divided by the diametral pitch will give the total depth of tooth directly. It is found by combining and reducing the two regular formulas $s = \frac{1}{P}$ and $s + f = \frac{1}{P}\left(1 + \frac{\pi}{20}\right)$, inasmuch as $s + s + f$, or $D'' + f =$ the whole depth of tooth.

This constant may be in common use among gear men, but I have never run across it in any of the hand books with which I am familiar.

R. E. FLANDERS.

The Toolroom.

Editor American Machinist:

If there is one property more than others common to all men in the shops, it is the one brought to mind by the old saying that "What's everybody's business is nobody's business."

Little suffers more from neglect than that which is entrusted to the care of all the men. The lonely fellow who is orderly and willing to do his share of "everybody's" business is usually soon overwhelmed by the prevailing spirit of the majority and not only abandons all hope of better conditions but frequently, in a sort of self-defense, surpasses his masters in the "art."

I well remember, about twelve years ago, after having spent a few years in a shop where I was alone in my class of work, starting to work in a shop where I always found the can over the grindstone empty and that it was some time before I noticed that the other fellows always had tools to grind immediately after I had filled the can and finished my grinding. I also remember that as soon as I was "on to" their game I commenced putting in just enough water for my own grinding. Only a saint could continue to play servant for the other men under those conditions, and hence it is that the pace of unorderliness is set by the most slothful (or lazy?) one among them and the rest, unwilling that he should make good time at the expense of theirs, are gradually forced down to his level of conduct.

The fact is that most of the men would be orderly if *all the rest* of them were, and this renders reform less difficult, but I do not believe it is physically possible to successfully reform any shop, even the smallest, without the most stringent rules; and these rules, unlike Chicago city ordinances, must not only be established, but continuously, uninterruptedly enforced.

To enforce rules of orderliness and neatness nothing is more helpful than a good toolroom system. The mention of a toolroom should not frighten the owner of the small or medium-sized shop, who entertains the mistaken idea that a toolroom is a luxury only for the "high-toned" shops and that he cannot afford such expense.

To him permit me to state that the saving in small drills and taps alone will in most cases pay a handsome dividend on the cost of installing a good toolroom system.

And this need not be high. A plain wood partition about 4 feet high and poultry netting above this is good enough for any shop. Appearance counts for but little. The good qualities of the system and its strict enforcement are what count the most.

While the toolroom need not be anything fancy, it must contain accommodations for all the tools required and accommodation does not refer to room alone, but the tools must be so disposed that they may readily and quickly be found by the attendant. The rules and regulations, like the toolroom, need not be elaborate. The following, modified to suit individual requirements, will be found sufficient:

TOOLROOM REGULATIONS.

1. A check will be handed in for *every* tool received out of the toolroom. This check will be put in place of the tool until such tool is returned, when the check will be redeemed.

2. No tool shall be kept out of the toolroom any longer than is necessary, and shall be clean and in good order when returned.

3. For tools returned damaged or broken, checks will not be returned until consent of foreman has been secured.

The attendant should be orderly and reliable. If the shop is small and the passing out and in of tools does not require all of his time, a cutter or drill grinder or other tool or vise may be placed in the toolroom and work given him to do while he is not otherwise engaged. Such work should be of the kind that can readily be interrupted without affecting it. A call bell should be provided at the counter.

Having installed the toolroom and put it in operation, the effect will almost immediately be noticed. The men who have been breaking the most tools will complain about "having to take two men's time to find a miserable little tap." Others will hail its advent with delight, as each man will be held responsible for his own mistakes, and there is no possibility of, as without the system, the wrong one being suspected when a tool is found broken or has disappeared.

That this has a wholesome effect on the shop needs no proof and yet, should we stop in our efforts to improve conditions after having installed the toolroom system, it would be found that but a partial cure had been effected. Everything cannot very well be kept in the toolroom. Lathe tools, bolts, straps, clamps, wedges, files and a thousand other things must remain distributed among the machines and benches, and there is no good reason for expecting these to be kept better in order than were the other tools when still kept within reach and in the care (?) of all.

The vigilance necessary to exert in keeping these things in order will prove quite a task, though not nearly as difficult as before the installation of the toolroom and the better class of men will have a

much greater incentive for keeping the tools in their charge in good order.

To sum up, a good toolroom system is not a luxury, but a paying investment in even comparatively small shops, and while the saving effected thereby is not so easily calculated that it can be done with mathematical precision, the saving is made nevertheless, but such system is not complete in itself and is but a part, and an important one, of a complete system that should pervade the whole manufacturing institution.

There is, however, no such thing as "installing" such a system and, having done this, to rest, for, like advertising, it must be kept up everlastingly to bring success. CORNEIL RIDDERHOF.

Removing Wrinkles from Tracings — Tracing Symmetrical Curves—Mental Calculations.

Editor American Machinist:

The wrinkles which appear in tracing cloth after it has been damped with color, etc., can easily be removed by ironing, either with an ordinary flat iron slightly heated or, if that is not handy, a steel rule, held in a gas jet for about half a minute will answer very well.

When drawing out a machine it often happens that a curve has to be drawn on one side of the machine, which is a converse of one on the opposite side. When the curvature is great or difficult to duplicate and it is desirable for the appearance of the drawing that it should be very similar, the quickest way is to trace the curve already drawn, fold the tracing paper, adjust it to its correct position and prick the curve through. Tracing paper will often save time when laying motions, etc., as the different levers may be traced on separate pieces of paper, moved about in their respective positions, and the effect noted on the drawing beneath.

I do not wish to be understood as disclaiming the value of absolutely correct answers to calculations where necessary, but even in these busy times the value of "good enough" is not always understood. Calculations are often worked out to a degree of fineness, which, in view of the data, is fallacious. I noticed an instance of this the other day, in which the weight of some forgings were worked out to two places of decimals, the answer being in pounds. Often a rough approximation is required quickly, and if the calculations are not too long, mental arithmetic is a great advantage. It is astonishing with what ease and rapidity calculations can be thought out after some little practice. The following method of finding quickly a square root is approximate generally to three figures, and is useful when the slide rule is not handy, and has the advantage that, with practice, one can find the root mentally. Proceed in the usual way of dividing off the figures in twos, starting from the decimal point, and find the nearest root for the first figure or figures. Bring down the next two figures to the remainder, and divide by twice the first figure already found. The result will be the second and third figures of the root.

Examples:

9.76	3.12		27.84	5.28
9			25	
6 | 76			10 | 2 84	

The square of a number is equal to product of any two numbers whose difference from the number to be squared is equal, plus the square of the difference. This rule sounds clumsy, but it is valuable for squaring mentally, as it is usually easy to select two numbers whose multiplication is easy, and whose difference is not great.

Examples:

$43^2 = 46 \times 40 + 3^2 = 1849.$

$58^2 = 60 \times 56 + 2^2 = 3364.$

It is, I believe, by rules similar to these but considerably extended that lightning calculators work. H. T. MILLAR.

Manchester, England.

Silicate of Soda in Casting on Cold Metal.

Editor American Machinist:

The iron foundryman sometimes is called on to make a casting with an iron or steel shaft laid in the mold and the molten metal poured around it, and the metal over the top of the shaft may be subsequently found to be full of blow-holes. That the metal may lie quietly on the shaft as the mold is filled the expedients adopted by the different foundrymen are according to their opinions and facilities at hand. In some foundries, when the casting is not to be finished, one will chalk the shaft or paint it with a mixture of red lead mixed with naphtha. The naphtha evaporating leaves a coating of the red lead, which seems to work fairly well, provided the surface of the shaft has been turned or ground off before painting, but still there is no certainty of good results.

When a casting is to be finished over a shaft cast into the casting, or when chaplets are used in work that is to be steam tight, the tinning of shaft or chaplet is resorted to, as it is found that the tin fluxes the metal on to the shaft or chaplet, causing the molten metal as it cools to adhere firmly or to unite with the steel. While in all probability this is the safest or surest way of obtaining the desired result, it is often inconvenient and costly, and the time involved is too long; hence the foundryman is expected to know of some quick way to produce the desired result, and while he may succeed nine times he may fail when the casting is wanted in a hurry, which may be the tenth time.

I have tried the above ways, also putting on creosote, shellacking also, but have not always been successful, and have never felt safe except when shaft or chaplet was tinned. Some few weeks ago, in conversation with Mr. C. W. Bogart, of Buffalo, he mentioned the use of silicate of soda. A number of times, having occasion to cast iron on to shafts, I have taken the shaft and warmed it to a blood heat and then given it a coating of the above, applied with a brush. The thin coating hardens very quickly, giving the shaft a glazed coating. The mixture is commonly called liquid glass; the jar containing it must be kept well stoppered, but it does not harden in the jar very fast. After using the brush it must be well washed out with hot water, as if left it will be as hard as glass the next day. Pouring the metal fairly hot and flowing a little through gave satisfactory results.

I tried the following experiment: Taking a pulley hub, some 8x10 inches, and casting it with a shaft 2 inches in diameter turned off smooth and treated as above in the center, the next day the casting was put in a hydraulic press used to force cranks on stationary engine shafts, and it required a pressure of 22 tons per square inch to move the casting on the shaft ⅛ inch, while the casting had every appearance of being solid.

The above in thickness is syruppy, nearly whitish in color and costs here 18 cents per pound. I am told it has also been used successfully on shafts around which brass or composition was to be cast. I would like to know of the experience of others in using the above; also its use in spraying molds. R. H. PALMER.

A Little Grinding Experience.

Editor American Machinist:

Among the most interesting and fascinating operations in the mechanical line are those performed by the grinding machine. As made to-day, when operated by intelligent persons, it is a most economical tool. I have read with interest the articles on grinding, as published by the AMERICAN MACHINIST from time to time. My own experience in grinding dates back to eighteen years ago, when it was thought that the grinding machine was strictly a toolroom machine, and it was very seldom that it was seen in any other department. Outside of grinding reamers, cutters, etc., it had very little to do. The grinding machine has now taken its proper place in the modern shop, and the results obtained from it are well known to manufacturers in this country and abroad.

I am in charge of a department in this city where single-phase electric motors are manufactured, and the equipment for machining the shafts for these motors is no doubt one of the best made. It consists of a No. 14 plain Landis grinding machine and a 2x24-inch Jones & Lamson flat turret lathe. These shafts vary in length from 12 to 44 inches and from ½ to 2 15-16 inches in diameter, all sizes up to 2 inches inclusive being turned on the flat turret lathe, with an allowance over size for grinding of .005 inch, except on the pulley end, which is turned to standard size, the larger shafts being turned

in standard engine lathes. I use a carborundum wheel, 20 inches diameter, 1½-inch face, grain 365, grade M. This wheel gives most satisfactory results, and was selected after considerable experimenting, the shafts being made of high-grade machine steel. The grinding of these shafts is a strictly manufacturing proposition, as much as any other operation.

The surface speed of the wheel is about 5,500 feet per minute; the rotations of the shafts necessarily will vary with their diameters. For shafts from ½ to 1 inch we run at about 425 revolutions per minute, with a traverse of the wheel of about 8 inches per minute; for shafts from 1 to 2 inches, about 300 revolutions per minute, traverse about 6 inches per minute; for shafts from 2 to 3 inches, 200 revolutions per minute and traverse 4½ inches per minute. I use the full width of face of the wheel with these work speeds and wheel travel, and they have given entire satisfaction as regards finish and size, the limit of size being .001 inch.

Chatter marks, a source of trouble to a great many, can be avoided in almost every case if the operator will keep his wheel true. It is also very important that the wheel spindle be kept a very close running fit. If it gets a little warm, so much the better, as a slight warming up does more good than harm. If the work is long and slender, it is important to have the back rests to support the work in the right place. I use the back rests on all sizes, and believe that without them good grinding could not be done. These are easily applied and adjusted on the modern grinding machine. A coarse wheel, working under the proper conditions, will produce a very smooth and polished surface, and will not fill up and glaze like the fine wheel. Study your grinding machines as you do your turret lathes and other tools, and you will be surprised at the results. J. H. B.

St. Louis, Mo.

"Self-Hardening" Steel as "High-Speed" Steel.

Editor American Machinist:

I have been buying sample bars of every make of high-speed steel that I have come across. In working these up into tools (I generally do this work myself because of the knowledge to be gained) I noticed a great similarity in many ways to the common self-hardening steel, so last week I took an old lathe tool made from what was a very poor bar of self-hardening steel from a well-known firm. I dressed the tool to shape, heated the end till it began to fuse, took it out of the fire and allowed it to cool to a bright cherry red and then quenched it in fish oil. The tool after grinding has lasted longer without regrinding and given better results than any high-speed steel I have so far met with, and that at a cost of 40 cents per pound against 85 cents. (I may be out a few cents either way on these prices.)

I would like to have the opinion of Mr. E. R. Markham on this subject, should this meet his eye. E. A. Suverkrop.

Good Tool Room Advice.

BY U. A. JAMES.

Even a poor toolroom system is, in many cases, better than none at all; but there can be no question as to the benefits to be derived from a good arrangement of the necessary tools for use in the shop. A good toolroom system depends on several things, some of which are: 1. The location of the room. 2. The attendants. 3. An adequate supply of necessary tools. 4. The care of the tools. 5. The arrangement of the tools to suit the conditions in the shop.

The toolroom ought to be located as near the center of the area that it has to supply as possible. The room must not be too small; there ought to be a place in which to put each tool, not two or more tools in the same place. Have plenty of light. Do not locate in some dark, out-of-the-way place, because all dark corners are reserved for the grindstones. Make the conditions in the room such that if the boys who work there want to do right it will be possible for them to do so.

The importance of having the right kind of attendants in the toolroom is sometimes overlooked. Young men from eighteen to twenty-five are the best for this work. Teach them the way you expect them to do the work. Pay enough wages to make their work interesting and to compensate for the back talk they will have to stand for without returning in kind. The good service you will receive may surprise you. That any kind of a man is good enough to pass out tools is a costly mistake for any proprietor to make. Do not feel bad if, as you pass the toolroom, you see the attendant sitting down; because if he is a good one he has earned his short rest, and if none of the workmen are waiting for tools they are probably working, and that is where you want them to be and not waiting for tools.

Many tools in a good toolroom are not used very often, but still it pays to have them there. Of the ordinary tools that every person uses a good supply ought to be kept. Do not have two or three men trying to use or waiting for one tool. The time saved in not having to wait will more than equal the amount spent for a few extra tools.

Time can be saved by proper care of the tools. Each tool that has been used should be examined when it is returned and before it is put away. This examination must be very short in most cases, as it is not allowable to keep the workman waiting; but still an eye inspection can be given as the tool is being put away and a more careful one can be made at the toolkeeper's convenience. At least some of each class of tools must be ready for use at any time. All dull or broken tools must be put to one side for repairs. Tools should be marked with at least the size, and the places where they are kept should be marked to correspond. In some cases where there are more than one tool of a kind they should be marked, in addition to the size, with consecutive numbers, and the place where they are kept marked the same, and they should be charged to the men by these numbers.

Time can be saved by arranging the tools in sections to suit the conditions in the shop. An example would be: 1. Lathe section. 2. Drill section. 3. Milling section. 4. Erecting section. 5. Miscellaneous.

Of course the work done in each particular shop will determine what these sections will be. Now, if the lathe department is in the north end of the shop, we would locate the tools for that section on the side of the toolroom nearest the work. This may not seem very important, but it is, for the reason that in a short time the men learn where the tools are located and go directly to that point. The attendant meets them and can serve them at once without any unnecessary running about. This also does away with any chance or cause for an argument about what side of the toolroom a man is to apply.

A toolroom as here suggested will save in the following ways:

1. Everything you have in the shape of tools will be found in one place; no time will be lost in looking in any other.

2. The workmen are met at the toolroom window as they come up and are being waited upon almost at the time they are telling what they want.

3. Quite often workmen come to the toolroom not knowing exactly what they want, or, if they do know what they want, they are not able to express themselves. A good attendant can and will help them in many ways to get what they want. And even if he has not got what they ask for he knows of something that may answer their purpose.

4. With a well-equipped toolroom and a wideawake attendant inside, the men have no chance or excuse for talking and loafing around, as it will take all their spare time telling the tool-keeper what they want. If they should stay after being waited upon, they would be politely asked to move and if they did not it would then be up to the foreman on the floor to take care of it, and in most cases he would be only too pleased to do it.

5. In large concerns where several floors are used, it pays to have small distributing rooms near the work. These rooms would only have the tools that were most called for.

If 10 per cent. of air is mixed with coal gas, its luminosity is reduced to 33 per cent.; with 20 per cent. of air the luminosity is only 7 per cent., while with 40 per cent. of air the flame becomes non-luminous.

Two English Automatic Screw Machines.

The accompanying engravings serve to illustrate the principal features of a couple of screw machines or turret lathes recently constructed by Alfred Herbert, Ltd., of Coventry, England. These machines are in general design very similar to the Herbert regular automatics for bar stock; in each case, however, important modifications have been made to adapt the tool to the economical handling of certain classes of work entirely different from that manufactured from the bar.

While we have classed both machines as automatic, the one depicted in Fig. 1 is not completely so in the full sense of the term, as the chucking is accomplished by hand through the medium of the upright lever located near the end of the head. This machine has been arranged especially for dealing with many of the castings required in textile work and a number of which may be seen in the half-tone, and for machining also larger castings and those having awkward outlines. It therefore forms a step between the hand turret lathe or chucking machine and the entirely automatic tool with magazine equipment for handling castings, and is particularly adapted for work which from its nature cannot be chucked true automatically, for use in cases where the quantities are not large enough to justify the design of a special magazine, and when the time required for machining is long enough for the operator to visit each machine once for each article produced.

The chuck, which is controlled by means of the hand lever and toggle motion shown to the left, is operated through mechanism in the spindle similar to that shown in the line drawing of the magazine machine. The three jaws, it will be noticed, are here actuated through internal rocker levers in the same way as were the chuck jaws in the magazine machine built by the same concern and illustrated by us at page 1195, Vol. 25. The powerful spring which the spindle contains enables the chuck jaws to give a little so as to accommodate slight variations in the sizes of the castings; and, as the jaws are removable, they may readily be changed to suit jobs of different shape.

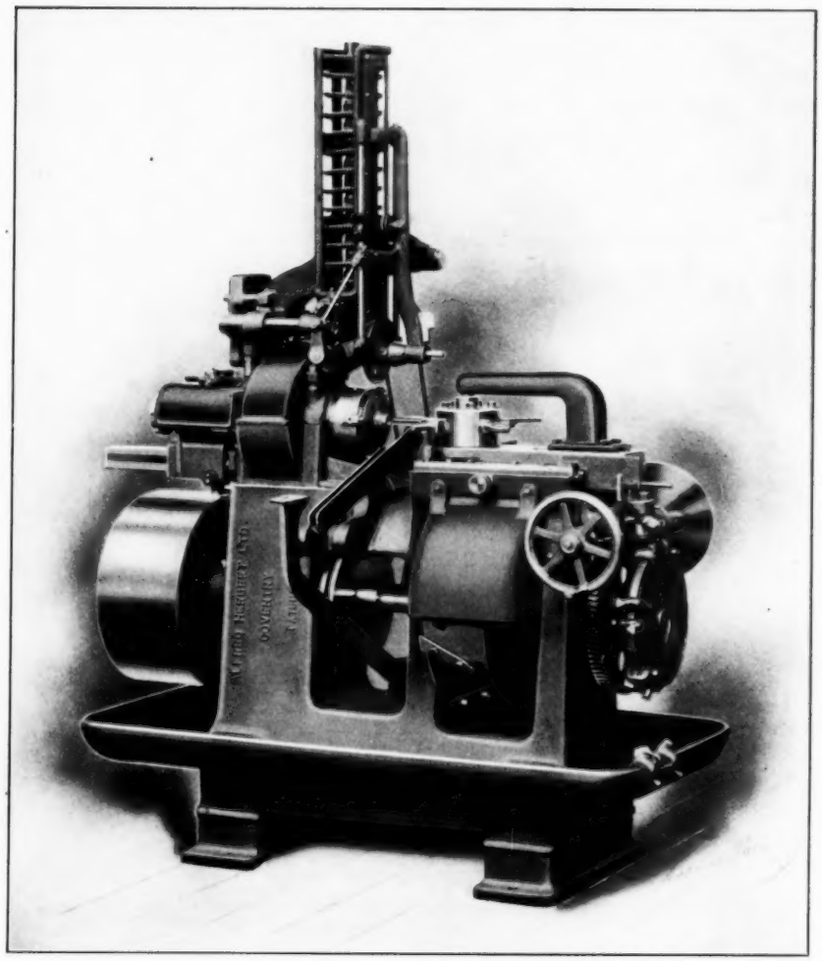


FIG. 2. MAGAZINE MACHINE.

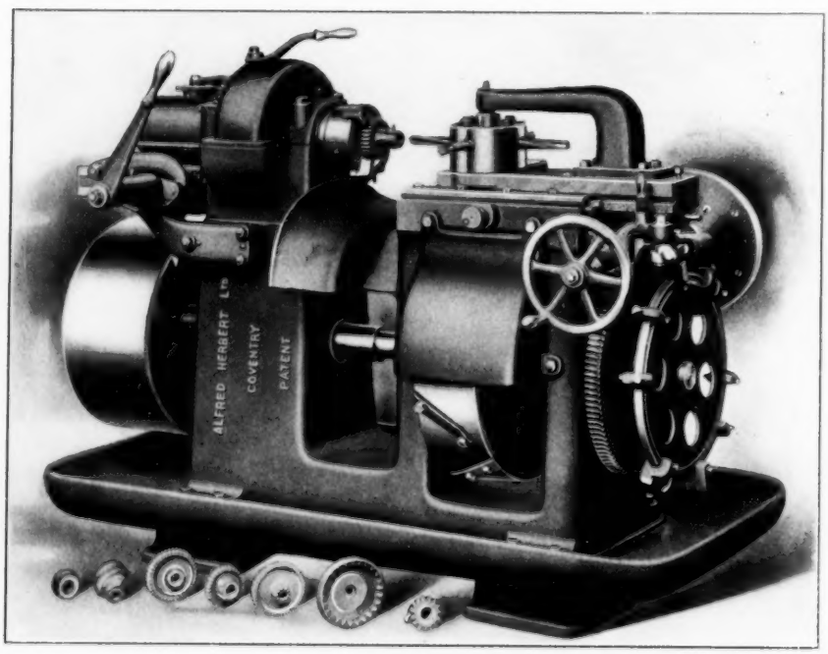


FIG. 1. MACHINE ARRANGED FOR BORING AND REAMING GEARS.

When chucking work, or at any time, the machine may be stopped or started by hand by the horizontal lever shown at the top of the headstock. Where the castings in question are fairly simple, they may be chucked without stopping the spindle. But, when handling certain pieces which are of irregular shape or which have projections that might catch the jaws, the spindle requires to be stopped; the operation is, however, very quickly performed by the lever mentioned. After the various machining operations have taken place, the machine stops automatically ready for the work to be changed.

The operations performed by the machine illustrated consist only of boring and reaming, the parts being machined at the rate of two per cycle of the turret. When required, however, the machine is fitted with a cross-slide and with turning tools for the turret so that objects having complicated forms can be finished without difficulty.

In Figs. 2 and 3 is illustrated a type of magazine for handling pieces which have a diameter exceeding their length, and

which, therefore, cannot be pushed axially along a trough, as could the pieces dealt with in the magazine machine previously illustrated. The work shown by the photograph consists of cast-iron skew bevel gears, large quantities of which are used in spinning machinery.

The castings in the magazine are supported by a couple of horizontal plungers or detents *A* which engage with the lowest casting at the proper point in the cycle of operations. Two levers *B* lift up the whole column of castings and then withdraw the plungers *A* which hold them up and which are held out of action by spring catches *C*. The castings are then lowered until the lowest one has passed the plungers which are then released by two cams, and, being actuated by springs *D*, shoot back into place, holding the main column, but allowing the lowest casting to descend with the levers on to a pin *E*. This is mounted on a pivot and rotates through an angle of 90 degrees, the drawings showing it dropped into its horizontal position. A rod *F*, operated through plunger and lever by a cam *G*, next pushes the work on to another guide pin *H* which is in line with the first one and carried by a vertical frame *I* which at the proper time descends until the carrier is opposite the three open jaws of the chuck *J*.

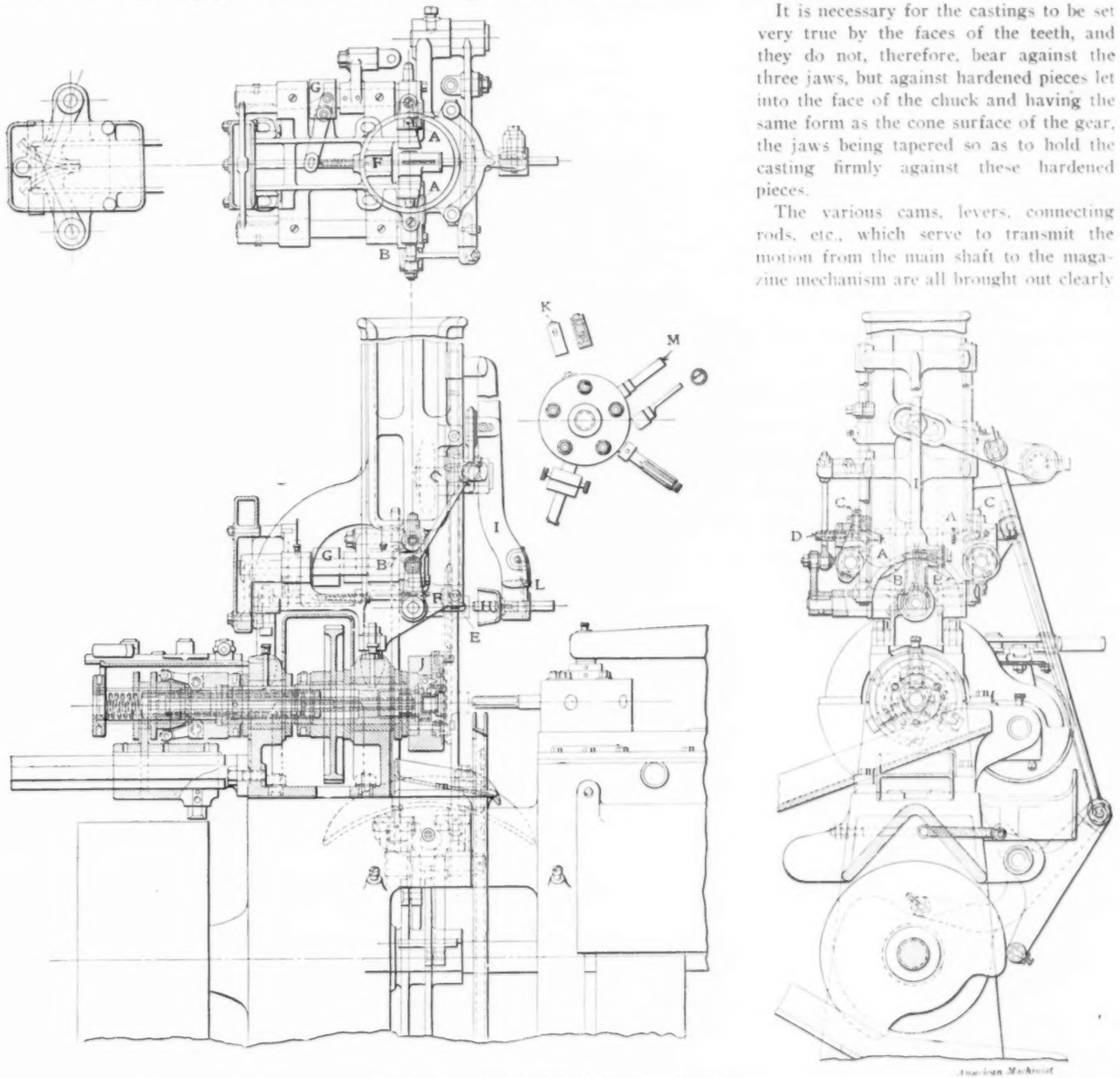


FIG. 3. CHUCK AND MAGAZINE MECHANISM.

The spring plunger *K*, carried by the turret, pushes the guide pin *H* forward and thus places the gear in the chuck which immediately closes upon it and holds it firmly. The pin *H* is returned by a spring *L* and the frame then ascends to its original position where it receives the next casting, while the machining operations are being performed on the casting which is already in the chuck.

For removing the finished gear from the chuck, the turret carries at *M* an appliance resembling an inverted D-bit, and which enters the hole in the work previous to the opening of the chuck. After the chuck is opened the work is withdrawn, and as the turret moves back the casting catches on the edge of the inclined slide or chute, down which it rolls, then drops into another chute running through the body of the machine and is deposited in a box at the back.

It is necessary for the castings to be set very true by the faces of the teeth, and they do not, therefore, bear against the three jaws, but against hardened pieces let into the face of the chuck and having the same form as the cone surface of the gear, the jaws being tapered so as to hold the casting firmly against these hardened pieces.

The various cams, levers, connecting rods, etc., which serve to transmit the motion from the main shaft to the magazine mechanism are all brought out clearly in the line drawing or the half-tone, and their arrangement will be readily understood without further explanation.

A Model Mint at St. Louis.

Among the most interesting of the exhibits at the Louisiana Purchase Exposition will be a model mint which will be shown by the Treasury Department. It took six months to prepare this model installation, and it will be erected by Edwin S. Church, Superintendent of Machinery

in the Mint, to be ready for steady running after April 29. It will show the process of coining from the melting of the ingots to the finished coin. Instead of coins the model mint will strike the official Exposition medal, of the size of a $20 gold piece.

Employees of the mint will also exhibit a gas plant, similar to the one in use in that institution.

For comparison with the modern miniature plant one of the first coining presses used, the oldest in existence, dating back to 1795, will also be exhibited by the Philadelphia Mint. Another feature of the exhibit will be 4,000 coins and 700 medals selected from the Mint collection by Henry H. Goodrich, the curator.

State Insurance in Germany.

BY HENRY HESS.

As may be more or less known to the readers of the AMERICAN MACHINIST, there is in use in Germany a form of insurance of all wage earners guaranteeing to them certain payments in case of illness, disability or old age and extending these benefits to the next of kin, so far as they are dependent. With certain minor modifications, this insurance is obligatory for every workman; the constituted authorities of the state see to the collection of the payments or premiums and attend to the disbursements of the benefits.

The funds from which the benefits are paid are derived from three sources: direct contributions by the wage earners or beneficiaries, direct contributions levied on the employers and the indirect contributions by the entire people made from the national funds.

Insurance is compulsory in general for all such employees as are classed as working men or women, servants and sailors, independently of the amount of their wages; also for all other persons whose income from their occupation annually does not exceed $475; small employers, small independent manufacturers who do not employ others, foremen, draftsmen (so-called technical employees), teachers, shipmasters, etc. The fact of the inclusion of these members of the population shows that the state aims not merely at a so-called workmen's insurance, as it is frequently termed by its opponents with a view to casting on it the stigma of class legislation, but rather that it tries to benefit all persons whose incomes are so small as to practically preclude their ever accumulating sufficient capital to live on in case of accident, ill-health or old age, and this quite without reference to the class of society they may come from.

Nor are the benefits restricted to natives or citizens of the country, but are extended freely to all persons coming within their range economically, regardless of nationality; foreigners remaining in the country for short periods only of course neither contribute nor benefit.

Naturally also exemption from the operation of the law is granted under certain conditions, chief of which is the receipt of an income aside from the returns for regular work, provided such income is at least equal to the earnings in the highest compulsory insurance class.

Voluntary insurance is also provided for; this is extended to all persons not ordinarily classed as workingmen or women in the usual narrow definition of that term and who derive an income from their employment of between $475 and $715 annually; for anyone in receipt of a lesser income insurance is compulsory.

To avoid injustice to persons who, though originally insured in either the compulsory or voluntary classes, drop out by reason of a sufficient increase in income permission is granted to continue the insurance by keeping up the payments. Similarly, insured persons leaving the country may keep their insurance in force by continuing the payments.

There are many minor rules and regulations governing temporary inability to meet payments, reinstatement in case of forfeiture of rights, release from contributions while deprived of earnings, etc. The intention is apparent throughout to extend the benefits liberally to all residents of the country of relatively small incomes independent of class distinctions, race, creed, nationality or any consideration other than substantial need and in a way that gives this aid not as a debasing or pauperizing gratuity, but as a right, earned and paid for.

The insured are divided into classes by the amount of the average annual income: I, up to $83; II, $83 to $131; III, $131 to $203; IV, $203 to $274, and V, over $274. As may be readily seen, irregularity of employment as well as temporarily low or high wages might cause much trouble in arriving at a proper classification; to avoid this standard wage rates are assumed for various districts, trades and occupations; classification is made according to these standard rates in case of any doubt; the local authorities are empowered to fix these rates within certain limits. Thus teachers are never classed lower than IV, even should their income not amount to the $203 of that class. Female servants are not rated higher than II, even though their income exceed the $131; this is evidently in equalization of their exclusion from sick benefits by reducing their contribution below the level of the class their income calls for.

Voluntary insurance at a classification higher than the income compels is optional provided employer and employee agree to the burden of correspondingly higher payments. The employee is not to be deprived of his right to insurance in a higher class by refusal of his employer to contribute; the latter may not be compelled to pay more than the normal amount for the class to which the employee's income corresponds. Entry to a higher class carries with it the benefit of larger returns for the increased contributions; but so far as my experience with workmen in the various mechanic and foundry trades and with house servants goes very little use is made of this privilege. Choice of class is optional for all voluntary insurance.

Payments are chiefly made weekly. Class I, 3.33 cents; II, 4.76 cents; III, 5.71 cents; IV, 7.15 cents; V, 8.58 cents. One-half of these payments is imposed on the employee and one-half on the employer. In return the state assures each person whose earning ability is permanently diminished to less than one-third a least amount of $14.30, $16.65, $19.00, $21.40 and $23.80 per year in classes I to V. In addition there is granted for each weekly contribution paid a further amount of 0.71 cents, 1.33 cents, 1.90 cents, 2.38 cents and 2.85 cents, so that those who have made the most weekly payments receive the largest returns. These sums are paid out of the sums accumulated from the levies made on the workmen and their employers; the state contributes from its general budget a fixed sum of $11.90 independently of the class. In order to be entitled to the annuity at least 200 weekly payments must have been made by those compulsorily insured and 500 by volunteers. In place of the annuity entrance to an invalid home may be granted the beneficiary.

Foreigners may, in case they give up their residence within the German Empire, be given a lump sum amounting to three years' annuity in settlement of all claims.

In case of recovery of the earning power beyond the stipulated one-third, the annuity ceases; it begins with the day of the disability.

Assignment or attachment of these annuities is permissible only under certain very sharply defined conditions.

An old-age pension or annuity is granted every insured person who has arrived at the biblical limit of life of three score and ten; its payment is independent of the persistence of earning ability; but at least 1,200 weekly payments must have been made to acquire the right to this pension; in order to extend the benefits to persons already well along in years, each year beyond forty is credited with forty weekly payments. Besides the state's general contribution of $11.90 for every class, the beneficiaries of classes I to V receive annually $14.30, $21.40, $28.50, $35.60 and $42.80. In lieu of the pension admission to an invalid home may be accepted. If payments have been made in several classes, benefits are paid based on the average payment.

The state maintains quite a large number of sanitariums, and has the right, in case of illness that endangers the patient's ability to earn a livelihood, to compel transfer to one of these sanitaria and so protect him and itself against the consequences of such loss by timely prevention. If the patient is married or contributes to

the support of a household, his consent to such removal must be had. During the illness partial compensation for the loss of support is made the affected household. The authorities are very quick to avail themselves of this phase of the law as soon as there are indications of illness, particularly so where that most prevalent scourge, consumption, is indicated. One case that came to my attention particularly was that of the shop photographer, a young man of, possibly, twenty five years; though slight and of delicate appearance, there was no special indication of illness; but, visiting the local free government physician for a slight cold, incipient consumption was found to have barely started in; the physician notified the authorities and one Friday evening a few weeks later the photographer came with a notice that on the following Monday morning he was to take a certain train (ticket enclosed) to a certain pine woods sanitarium for a three months' preventive treatment! On my expressing surprise at the summariness of the proceedings, it was explained as largely due to the places not being allowed to remain unoccupied, the departing guest being speeded and the coming one as well. Something of this summariness attaches to all of the functions of German and particularly of Prussian government, patterned on the ideas of military discipline in that essentially military state. While this feature strikes the foreigner, particularly if he hail from England or the United States, as an invasion of personal rights, the German, being used to it from childhood up, does not notice it. In this particular case compliance was not absolutely compulsory, but refusal would have involved difficulties in finding a vacancy at a more opportune time and possibly serious consequences such as curtailment or forfeiture of the invalid pension in case of the sudden, unfortunate development of the disease.

This very good idea of temporary residence in a sanitarium as a preventive of serious disease has been adopted by the voluntary assurance associations maintained by many large works for the benefit of such of their staff as are not subject to the provisions of the law. An American engineer, but recently employed by one of the large Berlin establishments, was found by their examining physician to be not quite sound as to lungs; to his no small astonishment he was at once excused from the conduct of his department and sent to the company's sanitarium for six weeks or so, with no curtailment of salary.

As these sanitaria are generally located in pleasant surroundings and everything is done for the entertainment and comfort of the inmates to make their stay pleasant only inveterate grumblers can find fault with them, even though to us they do savor rather much of our bugaboo of paternalism; that, however, is a large subject and quite "another story."

Refunder of payments to the extent of one-half of their contributions is made to women who marry, provided they have made not less than 200 weekly payments; this provision acts somewhat as a self-insurance for the "dot" so general in Europe.

The widow or children under fifteen years of age of an insured husband or father are also entitled to a refunder of one-half of the payments made, provided there have been not less than 200. The same provision applies to the fatherless children of insured women. Naturally there are a host of minor clauses, the recitation of which would unduly extend this account.

The manner of making payments is essentially simple. Though not absolutely germane to the subject, it is probably not amiss to mention that our pride in doing things better at home than they are done in the monarch ridden countries of Europe is decidedly misplaced as regards the conduct of the business of our government or large corporations; ours not only provides an enormously larger amount of red-tape to unwind, but make the process as inconvenient, costly and offensive to the individual and general public as seems at all possible. One need only remember the annoyances, positive rudeness and direct insult that the unfortunate, landing on our supposedly hospitable shore, whether foreigner or returning native, has to put up with, and to contrast these with the very general courtesy, expedition and decency of conducting the in itself sufficiently humiliating customs espionage, as that is managed on the other side of the big pond.

But to return to our mutton: Every insured person receives a card marked off into fifty-six fields; these cards are obtainable usually from the district police offices; it is well to bear in mind that in Germany the police has intrusted to it very many functions besides those of the apprehension and detention of malefactors; that, in fact, constitutes really the smaller part of its manifold activities. Into each of the fields provided on the card a stamp is to be pasted; such stamps are purchasable at any postoffice in values corresponding to the weekly dues of classes I to V; stamps for four weekly payments are also to be had. The duty of pasting in the stamps, colloquially and shortly known as "kleben" (English "pasting") devolves on the employer; the general provision is that pasting must be done at the usual wage-paying periods; the employer is entitled to deduct one-half of the value of the stamps pasted from the wages, but can recover in no other way, nor later than the next following payday. Each filled card is returned to the authorities in exchange for a new one and against a receipt of the value of the stamps pasted as payments made; such exchange must be made within two years from the date of the last stamp pasted under penalty of possible loss of validity.

That this compulsory insurance does work to the benefit of all concerned is now very generally conceded in Germany even by its original opponents and also in other countries that have made an exhaustive study of its workings; England, for instance, some time ago made the matter a subject of parliamentary inquiry resulting in a report recommending drawing up a similar scheme for the United Kingdom.

Life and accident insurance and private benefit associations, such as the Masons, Odd Fellows, etc., as we know them here, counting all classes of our population among their members, though not unknown in Germany, are there confined almost entirely to the wealthier classes. The state insurance consequently fills a want far more acutely felt than with us; the compulsory feature, while repugnant to our instincts, works for good in a country where a large measure of responsibility for the welfare of the individual is considered the legitimate duty of the ruling powers; the compulsion extends the benefits of insurance at once to those who would otherwise be but slowly, if ever, educated up to it. That with this insurance the constituted authorities stole the thunder of their chief opponents, the socialistic party, is not a cause for regret in the government camp. Nor should the fact that such insurance falls in with the tenets of the German socialists prejudice us against it notwithstanding that the bulk of our newspapers and others interested in keeping matters of general concern from general regulation discredit socialism by classing it with anarchism of the Most type; so competent an observer as the historian Mommsen has said of that party in the German Reichstag that it was the only one that a self-respecting citizen could consistently belong to, as standing on the broad basis of working honestly for principles looking to the best welfare of the entire people rather than the immediate aggrandizement of one class at the expense of the others.

Inquiry for Machinery.

(173) A correspondent asks for names of manufacturers of machinery "to assemble small tacks and tin washers."

The excellent series of free scientific lectures conducted by the Board of Education of New York city, not for the school children but for the general public, deserves frequent mention if there are any who do not know of them or who have not availed themselves of them. For the months of March and April there are additional courses, of from five to eight lectures each, upon astronomy, biology, electricity, physics and first aid to the injured. The lectures are illustrated by experiments or stereopticon views and are delivered in different parts of the city. Those interested may easily obtain the desired information from local notices which are widely distributed.

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The Carnegie Union Engineering Building.

The canvass of the ballots of the American Society of Civil Engineers which took place March 2 developed a surprising majority against the acceptance of Mr. Carnegie's proposition, the vote standing 1139 to 662.

It is understood that this vote in no way stops the carrying out of the project. Mr. Carnegie's original offer was not, we believe, contingent upon its acceptance by all of the societies, and it has been understood from the start that the action of the civil engineers was simply upon the question of their coming in or staying out of the circle. It would, indeed, be strange if their action could have any other effect. The other societies and the Engineers' Club have a combined membership of something like ten thousand which is substantially unanimous in favor of the proposition and, looked at in a broad sense, the adverse vote of eleven hundred of the civil engineers is a trifling minority.

In a sentimental sense the result is of course disappointing. That such an enterprise should go on without the co-operation of the civil engineers is a reason for real regret, though the smallness of view disclosed among the membership of the Civil Engineering Society is a more disagreeable development than their action considered as such. While financial and other motives have been put forth, there is no denying the fact that the real animus of the opponents of the enterprise has been an unworthy one—the idea that the only real engineering is civil engineering, that civil engineering embraces all engineering, that engineers going by other names are not the peers of civil engineers, and that for the civil engineers to occupy a house in common with others would lead to a loss of dignity on their part. That a large percentage of civil engineers is possessed of this idea and that it has been the mainspring of the now successful opposition to the acceptance of Mr. Carnegie's gift is known to all who are acquainted with the facts. That the feeling is so predominant among them, as the vote shows, will come as a disagreeable surprise to many, but, the facts being what they are, effective co-operation with the civil engineers would manifestly be out of the question and, that being the case, the situation is best as it is. We have already given expression to this sentiment at page 1066, Vol. 26, where we said:

"The conviction is growing upon us that it will be better for all concerned if the Society of Civil Engineers decides not to join the circle of those who accept Mr. Carnegie's gift. 'It is a condition, not a theory, that confronts us.' Regrettable as would be the absence of a representative society of the civil engineering profession from the building, it would be less regrettable than the presence of a lot of soreheads. It would, we believe, be better for the civil engineers to flock by themselves where they can hug their delusions and nurse their peculiar ideas of their own importance with less disturbance from the jostling of present-day conditions and of men who live in the present century and are looking forward to the next."

The magnitude of the adverse vote serves only to magnify these considerations. It may well be that this vote is a severe disappointment to Mr. Carnegie, but the disappointment will be temporary only. The building will still be *the* engineering headquarters of the country, in comparison with which the building of the civil engineers will rapidly sink from its present primary position to one of secondary importance. We have also given expression to this sentiment at page 850, Vol. 26, where we said:

"It would be one thing if the civil engineers by flocking by themselves could defeat the project, but with its success assured it is an entirely different thing for them to contemplate the going forward of this magnificent enterprise with themselves left out. This building is certain to become the recognized engineering center of the country, and if the civil engineers remain without the circle they must be content to see their headquarters, and with them their society, relegated to a secondary position, known and recognized by engineers, but unknown to anyone else. The more successful the enterprise the less can a society which considers itself national in character afford to remain outside. Even the civil engineer who regards his branch of the profession and its society as essentially and necessarily first in importance and precedence, as many of them honestly do, must wince as he compares this great headquarters, conspicuous by its size as well as by its character and uses, and located in a conspicuous center, with the modest building of his own society, located in an unfrequented street and section and known only to the few whose business calls them that way."

In this vote the civil engineers have, of course, made an exhibition of themselves. The widespread impression of them—that they are essentially reactionaries and petrifactions—is now shown to be justified. It was of course their privilege to do as they wished in this matter, but it is now the privilege of others to judge them by their acts. It is fortunate for them that their action cannot defeat the enterprise. Had that been the case, they would have earned the deserved ill will of all other engineers. As matters stand, they will simply be looked upon as an association of snobs who have injured themselves but no one else.

Though it seems useless to comment now upon their action, it is instructive nevertheless. Here was a plain business proposition which could be considered properly upon strictly business principles only. It was not professional, it was not social, it contemplated no amalgamation of the societies nor any joint action as societies either professionally or otherwise. The

only question was: will you (the several societies) occupy the same building to be donated for the purpose, and in order to save the expense of maintaining several separate and necessarily inferior and inadequate buildings? Instead of sticking to the consideration of this simple question, all sorts of totally irrelevant things were brought into the discussion. A few particularly noisy and hare-brained individuals conceived the idea that an amalgamation of all the societies was really aimed at, that such an amalgamation would be a deep disgrace and degradation to the "only engineers," and they were actually able to make so much noise harping upon this one string that the voices of the sensible, well-balanced and modern-minded members were scarcely heard above the din. There is no denying that the result of the vote is a disappointment and a surprise to most of those who have friends among the Civils. It would scarcely have been believed to be possible that such a large proportion of their membership would pursue such a misguided course.

The building project will of course go on. Engineers worthy of the name are not likely to let a thing so desirable to be accomplished go undone if by any means within their power they can bring it about and Mr. Carnegie is not a man who, when he has put his hand to the plow, is prone to look back. But the principal advantage of the plan is the dividing of the expense of maintenance of one good building between several societies, and of course the more societies join in the project the more the expense will be reduced for each society. To be consistent the civil engineers should now vote for the erection and constant maintenance in New York of a hotel large enough to accommodate their entire membership in attendance at any convention to be held here and not to be used by any other persons at any other time, especially by persons who may be members of any other engineering organizations or otherwise masquerading as engineers.

Hose Couplings.

At the recent disastrous fire in Rochester, when help was called for from other cities and promptly responded to by apparatus from Buffalo and Syracuse, it was "discovered" that the hose couplings from those cities would not fit the Rochester hose or hydrants. It happened that there was a nearby raceway from which water could be taken, and as sufficient hose was carried along with the engines they were able to render effective service. If there had not been a canal or raceway at hand from which water could be drawn by direct suction, it is more than possible that the engines would not have been able to render any assistance.

It will be remembered that this anomalous condition was discovered and investigated by a representative of this paper about three-quarters of a year ago. There is an utter lack of system or standard for hose connections on fire apparatus throughout the country. The presumption is that the hose connections of any city are more likely not to fit than to fit those of any other city. With no immediate knowledge of the matter, we may say that it is at least quite probable that the connections of Buffalo and of Syracuse, which would not fit those of Rochester, would also not fit each other, for the number of differences in exact diameters, in pitches and shapes of threads and in other particulars is practically unlimited, not to mention varieties of "patent" couplings in use which do not employ screw threads.

In the case of the recent great fire at Baltimore the same state of affairs was revealed. When the New York engines arrived in Baltimore, they at first all took position where they could get water by direct suction from a river or creek. We have information of one of those engines which was later sent to a hydrant. The hose would not fit, but it happened that the New York suction was so large that it could be slipped right over the hydrant nozzle and in that position it was actually *tied on*, and by that means the engine was enabled to get water and continue at work. The connections of the engines from Philadelphia and from Washington which responded to the call also would not fit those of Baltimore, and doubtless many interesting experiences resulted.

We could not have believed possible such a state of affairs as thus revealed, but we were compelled by indisputable and abundant evidence, and the matter was presented in considerable detail in our issue of June 18, 1903; we commend to fire departments and to insurance companies a careful perusal of the articles therein.

It should perhaps be suggested that the lack of a common standard in hose couplings carries with it other difficulties and inconveniences besides the lack of interchangeability between the apparatus of different cities. It entails additional expense both in first cost and in maintenance and renewal. It is one of the things of which there is absolutely no word to say except in condemnation or in wonder that its existence and still more its perpetuation could have been possible.

The Mining Engineers and the Carnegie Building

From a bulletin just issued by the American Institute of Mining Engineers we learn that at the recent Atlantic City meeting the following amendment to the Rules was adopted, subject to final adoption by postal ballot of the members and associates:

"The Council may at any time appoint a trustee or trustees, to hold property, real or personal, for the use and benefit of the Institute, upon such terms and conditions as the Council may determine."

This amendment is of course a formal action preliminary to the acceptance of Mr. Carnegie's offer, and there is no doubt that it will be followed by the acceptance of the offer.

A Service Test of Motor Wagons.

The Automobile Club of America has arranged to hold in New York a service test of motor wagons from April 4 to 9.

This test will be something new, and, it seems to us, will show the value of motor wagons much better than any former tests. The vehicles will be put into the regular daily service of the American Express Company and perform their work for a week.

Each wagon will carry an official observer of the Automobile Club, who will keep a complete record of the performance of the wagon, fuel or current used, repairs, etc. There will also be carried the driver and expressman.

Each builder will state the load his wagon will carry, and it will be loaded to that capacity at all starts.

As the Express Company have very accurate data on the costs of and maintenance of horse equipment for this service, it is more than likely that some figures of value to the world may be obtained.

Manufacturers of commercial motor wagons have always objected to the usual short test under special conditions as not being "practical." It seems that this test will be entirely practical, and a chance for every builder of a motor wagon to prove the courage of his convictions when he claims his machine has any points of merit.

Of course the Automobile Club are giving gold medals, etc., to all the six classes, which, by the way, are fixed by the load carried, from 1,000 to 6,000 pounds, but we are of the opinion that the real reward for even a fair record in this test will be orders for wagons that the makers will secure.

There has never before been a convincing demonstration of the value of the motor wagon over the horse-drawn vehicle, and the Automobile Club of America are to be congratulated on going to the bottom of the subject in such a way that the outsider can have something to base his calculations on.

Last of the Morgan Iron Works.

Among our obituary notices might very properly be placed a few words concerning the last days of the Morgan Iron Works, of this city. Two compound engines just completed for a government dredge, with cylinders 14 and 26 inches diameter and 18 inches stroke, comprise the last job to be turned out and the works will be closed. The surviving tools will be scattered and the property will be devoted to other uses. There was a time when the Morgan works had a national reputation and its engines were driving ships over every sea. The East River was lined with shipyards, and here, besides the Morgan works, were the Novelty works,

the Allaire, the Etna, the Quintard and others turning out the engines and machinery equipments for the hulls which were built nearby. The Morgan works began in the days of the side-lever and the beam engine for marine service, and its work had followed through the later styles as they developed. Many engines were built here for the navy during the Civil War. John Roach operated the plant successfully for years, and when he located at Chester so that he could build the iron hulls many of his engines were still built here. The business by which the works once flourished has gone elsewhere or has been so transformed that the old-time plants have entirely lost their hold. The world still rolls along even if other hands now push it.

The Ohio Supreme Court has, it seems, declared to be unconstitutional the law which had been passed by the Ohio Legislature making it a crime punishable by imprisonment for an employer to discharge a workman because the workman was a member of a labor organization. Though the men probably looked upon this law as one upholding their right to belong to whatsoever unions they might choose, yet in character the law was a restriction of personal liberty, *i. e.*, the personal liberty of the employer to employ whomsoever he chose, and we believe that in the end it will be seen that the less the legislatures and the courts undertake to regulate such things the better it will be for all concerned. If a legislature, considering more than it ought perhaps the possible effect upon the labor vote, may pass laws limiting the freedom of employers in this respect, then it may, when considering too much perhaps the source of the campaign cash-box supplies, pass laws limiting the freedom of the men, and in the end the one restriction may balance the other with a net loss to both classes of citizens. It is this consideration which makes us think that employers who are so strenuously contending for the upholding of "government by injunction" may be playing with a two-edged sword. This recent invention of jurisprudence is a subversion of the right of trial by jury, and if under it judges can be found who will fine and imprison workingmen for offences against judge-made law, then it is as sure as anything can well be that sooner or later workingmen will find means to have judges who will fine and imprison employers in the same manner. Personal liberty is after all the most important thing we have in America and whatever we may think our individual interests may demand, as citizens we should be very careful of any steps tending toward the curtailment of personal freedom. The right of trial by jury is fundamental; it was adopted after centuries of experience and conclusively shown that no man's liberties or property were safe without it. We should think twice before allowing any encroachment of it, no matter how great the provocation may seem to be.

Some New Things.

FOUR-SPINDLE DRILLER.

The driller shown in the accompanying engravings is equipped with an automatic quick approach and return for each of the spindles, and each spindle is positively fed by geared mechanism giving it eight rates of feed varying from 0.005 to 0.78 inch per turn. For driving there are four independent belts, the lower cones for which are actuated by a shaft driven from the main line through a belt on the pulley shown at the end. By means of frictions controlled from the front by the foot, any spindle may be started or stopped instantly without interfering with the others; and, by lifting a hand lever, may be thrown into action the automatic mechanism for feeding and returning any spindle, that member then proceeding with its work while parts to be operated upon are being placed under other spindles.

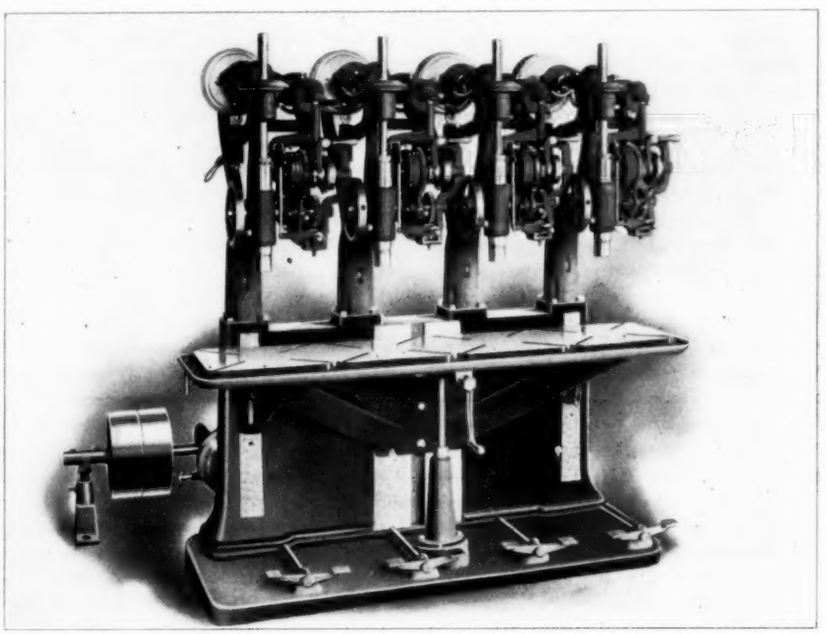


FIG. 1. FOUR-SPINDLE DRILL.

The brackets carrying the feeding and return gears are mounted, as shown in Fig. 1, to the right of the spindles. The arrangement of the mechanism will be understood from Fig. 2, where *A* is a part of the pinion shaft for moving up and down the quill and spindle, while *B* and *C* are the worm and worm gear through which the working feed is obtained. The worm gear, which is provided as indicated at *D* with clutch teeth, is loose on cross shaft *A*; but clutch *E* is feathered to the shaft and free to slide in and out of engagement with the clutch formed on the gear hub, and therefore when worm and worm gear are in mesh the shaft *A* is free to turn ahead faster than the worm gear, the clutch, being backed up by a spring, simply snapping in and out of engagement. The feed worm is driven from shaft *F* and has eight changes of speed derived from a feed gear similar to that used on the regular upright drill of the same builders and illustrated at page 100. The quick approach and return for the spindle is driven by shaft *G*, friction clutches *H* and *I* and gears *J* and *K*. Thus, as the feeding mechanism and the automatic approach and return are driven by separate shafts and the worm wheel is loose on its shaft, the worm and worm gear may be engaged by means of lever *L* and the spindle still be free for a rapid downward movement. When the spindle is at rest in its upper position the worm housing controlled by lever *L* is dropped on to stop screw *M*, thus disengaging the worm from the worm gear: at the same time the spring *N* through connecting rod *O* swings dog *P* under screw *Q*. The latter, it will be noticed, is carried with two other screws *R* and *S*, in the upper end of a rocker arm by means of which a sliding member *T* provided with a projecting key may be moved to right or left to operate either of the frictions *H* or *I*, and so clutch either bevel gear to shaft *U*.

The spindle is started downward by lifting handle *L* until stop-lever *V* catches under a hardened steel plate secured to this handle. This engages *B* and worm-wheel *C*; and dog *P* being under screw *Q* friction *H* is operated through rod *O* lifting, and gears *J* and *K* then rapidly drop the spindle until cam *W* (previously set) forces dog *P* under screw *R*. At the same time the cam strikes a fourth screw *X* in the rocker arm and forces sliding member *T* into a central position between the gears, thus releasing the quick-approach mechanism. The drill will now feed at the rate desired through the work or un-

til cam *Y* strikes stop-lever *V*, when the worm *B* will drop; at the same time spring *Z* causes friction *I* to be engaged, and the spindle rapidly rises until cam *A'* strikes *S*, and *T* is again forced to a central position between the gears. The spring *N* now brings *P* under screw *Q*, and the machine is ready to repeat the cycle. The cams are of course all adjustable on shaft *U*, and are set to suit the piece to be machined.

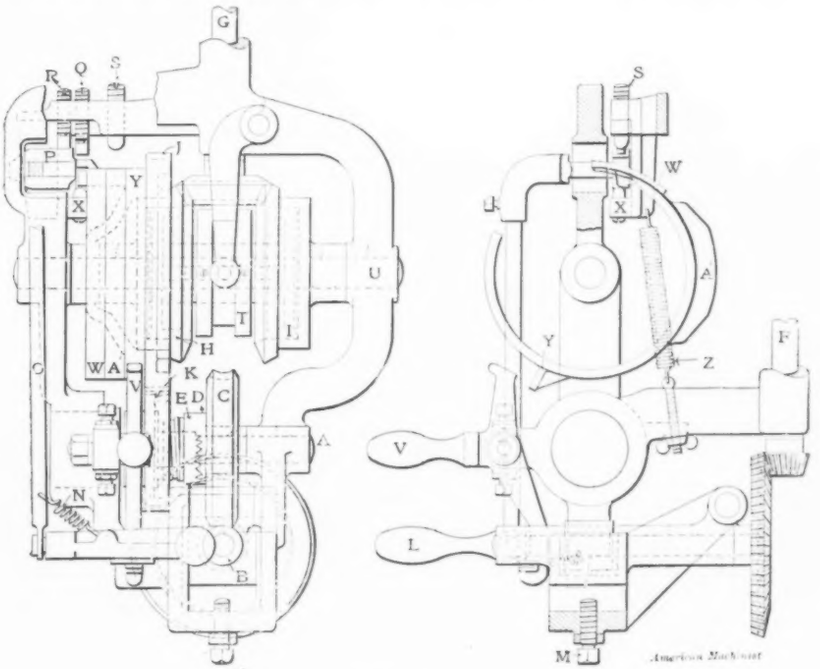


FIG. 2. QUICK APPROACH AND RETURN MECHANISM.

Fig. 3 shows a sliding chuck attachment designed for use with this gang drill. One of these attachments is located under each spindle, and the work, when once set in the chuck, is then easily shifted, chuck and all, from one fixture to the next, successive operations, such as rough drilling, second drilling and reaming thus being very conveniently performed.

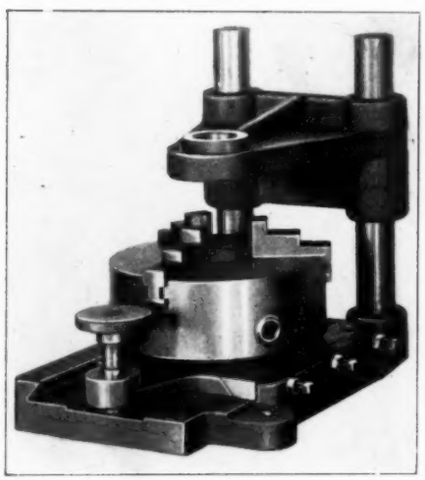


FIG. 3. SLIDING CHUCK ATTACHMENT.

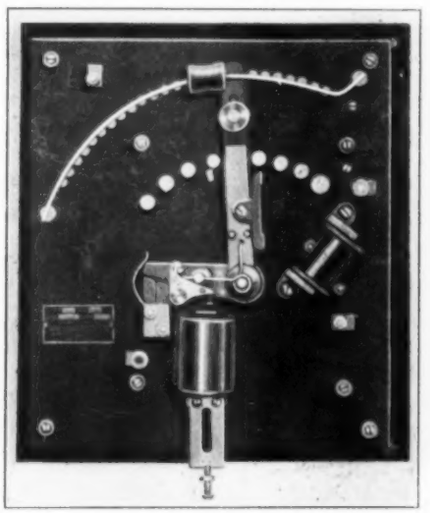
The drill illustrated has a work table 14x60 inches; this table has a vertical adjustment of 15 inches. The spindles, which are 1 5-16 inches diameter with No. 3 Morse taper holes, have a travel of 9 inches, are 15 inches apart (center to center) and each will drill to the center of a 19-inch circle. The maximum distance from spindle nose to table is 23¾ inches, and the minimum 8¾ inches. The fast and loose driving pulleys are 12 inches diameter by 4 inches face; the cone pulleys are 9 inches diameter on large step and carry 2-inch belts. The table is provided with T-slots and an oil channel; and, if desired, an oil pump is supplied with the machine. The drill weighs 3,000 pounds. It is built (as are also two- and three-spindle machines of the same design) by the W. F. & John Barnes Company, Rockford, Ill.

COMBINED MOTOR STARTER AND FIELD RHEOSTAT.

The accompanying illustration shows a new type of machine-tool controller which is the product of the Ward Leonard Electric Company, of Bronxville, N. Y., and which has several new features.

If the motor-starting lever is moved over the starting contacts too quickly, the overload circuit breaker (which is a part of the starting box) will open. This breaker will also open if the motor is started under too great an overload, and it protects the motor of machine tools from destruction, not only if the motor is running at full speed but also during the period of starting.

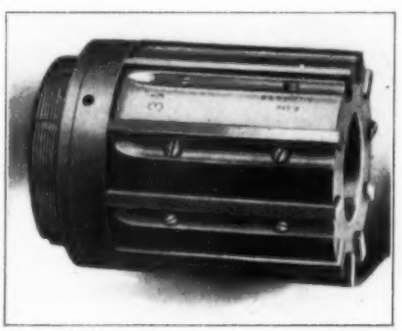
If the field is weakened to increase the speed, the starting arm will not fly back as the magnetization or holding power of the no-voltage release magnet is independent of the field strength. Upon pulling the switch, the starting arm flies back, carrying with it the field rheostat rider, cutting out all the field resistance. With this arrangement the motor cannot be started under conditions of weak field. The rider shown above the contacts on the brass strip can be moved to increase and decrease speed. This rider can be equipped if desired, though not so shown, with a pointer, a brass strip with a scale marked upon it being mounted in front of it in an arc with the movement of the rider—the scale to show the different speeds, the pointer on the rider to show the position of the rheostat and the rider to give such speed. With this arrangement a shop foreman can tell his men just what speed is to be used for any piece of work and the speed can be easily obtained by referring to the scale.



MOTOR STARTER AND FIELD RHEOSTAT.

ADJUSTABLE SHELL REAMER.

The body of the reamer is made of machinery steel with taper slots milled to receive the blades. From six to twelve blades, unevenly spaced, are inserted in each reamer, and these are adjusted by means of the threaded collar at the back end. The adjusting collar has a groove turned on the inside of its front face, this groove being formed to receive a tongue milled on each of the blades. Each blade is held in the body of the reamer inde-

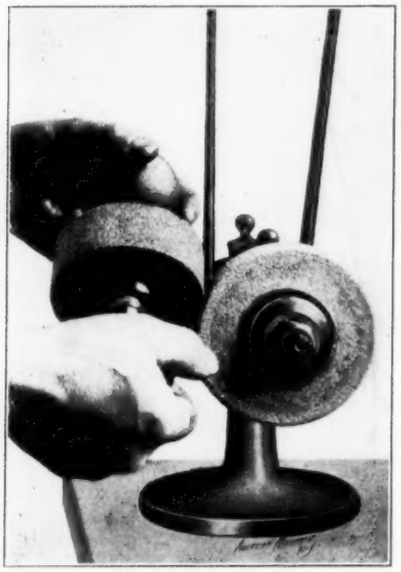


ADJUSTABLE SHELL REAMER.

pendently, the front side of the blade having near its lower edge a groove milled parallel to the bottom, forming a ledge upon which the ends of the binding screws bear. To adjust the reamer, the binding screws are eased about one-quarter turn. This will allow the blades to move freely when the spanner wrench is applied to the adjusting collar. The reamer is made by Schellenbach & Radcliffe, Cincinnati, Ohio, who manufacture also hand and machine reamers adjustable in the same manner as the one illustrated.

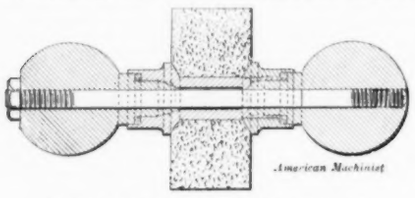
THE METCALF EMERY WHEEL DRESSER.

Fig. 1 shows the details of construction of this emery wheel dresser, and Fig. 2 tells the story of its use very clearly. As



METCALF EMERY WHEEL DRESSER.

will be seen in the half-tone, this dresser is used without a rest or guide, and yet it trues the wheel perfectly. To this result the inertia of the heavy ball handles is contributory. The dresser works best upon small wheels and is not recommended for sizes above 12 or 14 inches. It not only dresses a flat face as shown, but will bring up sharp corners on thin or delicate wheels. One curious result claimed for dressers of this type is that different conditions of cutting surface may be secured by holding the dresser at different angles.

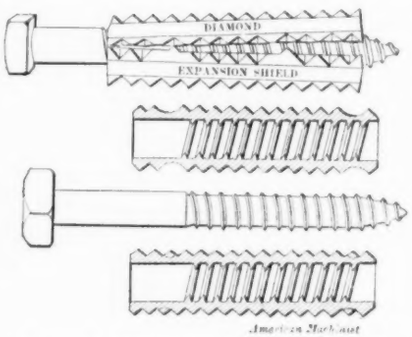


DETAILS OF EMERY WHEEL DRESSER.

Thus a wheel can be given a coarse, open face, for rapid cutting, by holding the dresser with its axis about horizontal, while a fine, close-grained face, for smooth work, will be produced by holding the dresser with the axis approaching the vertical. In either case it is said to give a better cutting surface than results from the use of the diamond, as it cuts out the band or filling sufficiently to leave the cutting points free to cut at their best. The wheel is securely mounted upon its central sleeve, and the conical bearings upon which it rotates are easily adjustable for wear. Felt washers in the overhanging portion prevent the escape of the oil, which is inserted by removing the screw plug at the right-hand end.

THE DIAMOND EXPANSION SHIELD AND BOLT.

The value of this device is evident at a glance, and no drawbacks to its use are revealed in its practical application. It provides a screw thread either permanent or temporary in places and in materials where the use of threaded bolts has heretofore been impossible. The ordinary coach or lag screws can generally be used and then it is only necessary to procure the shield. A plain hole is provided in the masonry or elsewhere into which the shield is slipped, and then the screwing in of the bolt expands the shield and its projections take hold of the material in

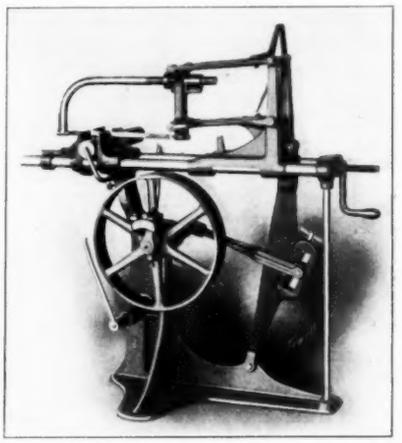


DIAMOND EXPANSION SHIELD AND BOLT.

which it is placed, and when the bolt is driven "home" the shield is firmly embedded. The shield is made in various sizes and either a single piece with a slit at the side or in two pieces. Bolts, studs, eyebolts, etc., are also made to use with the shields where so required. Made by the New Jersey Foundry & Machine Company, 9-15 Murray street, New York.

POWER HACKSAW.

The saw shown in the half-tone uses blades from 9 to 14 inches long and has a stroke varying from 6¼ to 8 inches to suit the work in hand. The saw cuts on the draw or backward stroke, the rocker arm which actuates the reciprocating frame being connected by a link to an extension on the under side of the frame, thus holding this down on the draw stroke, while the forward movement raises the frame and lifts the saw clear of the work. The stroke may be varied while the machine is in motion by means of the adjusting screw in the slotted rocker arm. An even pressure is kept on the saw during each cutting stroke and regardless of the position of the blade in the work, by a spring which is attached to a compensating device on the top of the frame. By swinging this spring connection toward the front or rear the pull of the spring may be increased or diminished to suit the condition of the saw and stock. The blade is readily adjusted in its frame to cut properly; and the saw is automatically stopped when the

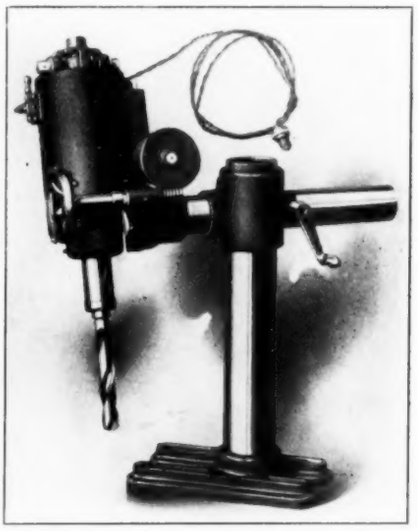


POWER HACKSAW.

blade has reached a certain depth in the stock or when it has completely severed the piece, by means of a tripping device acting upon the clutch shown in front of the pulley. The saw is built by the Fairbanks Company, New York city.

PORTABLE RADIAL DRILL WITH MOTOR DRIVE.

This tool takes drills up to 1¼ inches, and is provided with a 10-inch feed through hand-wheel and worm gearing, with a quick return by hand. It has a working radius of 24 inches and may be operated at any angle. The spindle is fitted with a ball thrust bearing and carries a No. 3 Morse taper socket. It has



PORTABLE RADIAL DRILL WITH MOTOR DRIVE.

two speeds controlled by means of a thumb lever at the lower end of the motor casing, and is provided at the top with a switch for starting and stopping. The vertical and horizontal supports are made of hollow steel tubing, and the base is

in the form of a letter *H*, with suitable slots for clamping bolts. The drill can be taken anywhere, as any desired length of cord can be used, the driving power being derived from an ordinary incandescent lamp socket on direct-current circuit. The weight of this tool is 210 pounds; the hight over all, 30 inches. It is built by the Hisey-Wolf Machine Company, Cincinnati, Ohio.

Technical Publications.

"The Indicator Hand Book—Part I, Construction and Application." By Chas. N. Pickworth. Second edition. 130 5x 7¼-inch pages with 81 illustrations. Emmott & Co., London and Manchester; D. Van Nostrand Company, New York. Price $1.50, 3 shillings.

This excellent manual received favorable notice at our hands on the occasion of its first appearance. The chief additions in the present edition are illustrated descriptions of external spring instruments which have been developed to a considerable extent in England, and to which American makers are now turning their attention. A novelty to American readers is the differential spring of Elliott Bros., the object of which is to obtain a large scale card near the atmospheric line but still have a small scale at a distance from that line. The change of scales is automatic.

"Alternating Currents: Their Generation, Distribution and Utilization." By Geo. T. Hanchett. 180 5x7¼-inch pages, with numerous illustrations. John Wiley & Sons, New York. Price, $1.00.

This book is intended more especially for those in charge of electric lighting and power plants who have a clear idea of the principles and operation of direct current electrical machinery, but whose understanding of alternating current apparatus is somewhat hazy. Without attempting mathematical analysis or extended calculations it sets out to explain the operation of alternating current apparatus and the accompanying phenomena. Considerable use is made of hydraulic analogies which are so useful in connection with direct current machinery. The book is not a primer and the reader will find a general acquaintance with electrical terms and phenomena necessary, but, given these, he will find the book instructive and useful.

"Facts About Peat, Peat Fuel and Peat Coke." By T. H. Leavitt. 115 4¾x 7¼-inch pages with 10 full-page plates. Lee & Shepard, Boston. Price $1.

This is an enthusiastically written and very readable account of the properties and possibilities of peat. It also states clearly the difficulties of making peat into merchantable fuel, and professes to tell how to overcome them. Under the latter head, however, we find very little satisfactory information. A 24-page chapter, entitled "How to Make Peat Fuel," is devoted chiefly to accounts of difficulties and of failures of methods which the author condemns, while all the real information is contained in two pages, and from these we can extract nothing that is definite. These two pages relate to what the author calls condensed, as distinguished from pressed, peat; but just what the distinction is we are unable to determine. The author claims to make peat fuel successfully at Lexington, Mass., and illustrations of his plant are given; but of his process, except that it condenses instead of compressing the peat, we are left in the dark. There is no doubt of the immense latent possibilities of peat in supplying the world's need of fuel, and there is just as little doubt of the immense practical difficulties in the way of the realization of these possibilities. Unless the author has information up his sleeve which his book does not directly disclose, it will do little more than direct renewed attention to the problem.

It will be remembered that in 1897 Mr. Charles C. Worthington, then president of Henry R. Worthington, presented to the School of Mines of Columbia University scientific apparatus to the value of $12,000 as a memorial of his father. Mr. Worthington is not now connected with the company, and the corporation claims that he ordered the apparatus and agreed to pay for it, while Mr. Worthington denies personal liability, contending that they were presented as a corporate gift.

An important transaction is the absorption of the Bullock Electric Manufacturing Company, of Cincinnati, by the Allis-Chalmers Company. This is understood to be one of a series of moves designed to bring the last-named company prominently into the electrical field. It is announced that Messrs. Bullock and Neave will remain in their present positions as president and vice-president, respectively, of the newly organized Bullock company, which will form one of the constituent companies of the great Allis-Chalmers organization.

Alberto de Permentier, Buenos Ayres, who has in charge the construction and equipment of a large preserved meat factory in Argentina, desires American manufacturers to send to him catalogs of and quotations on the following machinery: Equipment for meat-extracting plant, machinery for making tins; refrigerating plant, filtration systems, air compressors, ventilators and dryers; steam power plant, including engines, boilers, fuel economizers, condensers, etc.; electric light and power plants; pumps, hydraulic presses, rendering plants and steam cookers; also equipment for abattoirs, machine shop, iron and brass foundry, cooperage and carpenter shops, including metallic roofing, hoists, cranes, trucks, cars, rails, etc. It is requested that correspondence be in French or Spanish when possible.

Personal.

W. K. Palmer, M. E., consulting engineer, announces the removal of his engineering offices to Suite 402, the Lyceum Building, Kansas City, Mo.

J. L. Putnam has resigned his position with the Clark Automatic Telephone Switch-Board Company, of Providence, and is now with the Central Union Telephone Company, of Indianapolis.

A. Kennedy Ashworth has resigned as assistant manager of the Underfeed Stoker Company, Chicago, to accept the New England agency of the Buckeye Engine Company, Salem, Ohio. His headquarters will be Hancock Building, Boston, Mass.

Obituary.

George F. Evans, inventor of the well-known Evans Friction Cone Variable Speed Drive, died at Newton Centre, Mass., February 27, sixty years old.

James Holley, for thirty-five years in the employ of the Stanley Rule & Level Company, formerly as a contractor and more recently as a foreman, died in New Britain, Conn., February 15, sixty-two years old.

Zera B. Davis, for many years master mechanic of the Troy & Boston Railroad, now a part of the Boston & Maine, died February 27, seventy years old. Mr. Davis was a locomotive engineer for several years, and in a serious accident he was pinned under his engine for hours and lamed and otherwise disabled.

Ira Tompkins died at Troy, N. Y., February 23, sixty-five years old. His father was Clark Tompkins, who established a machine shop in Troy fifty-nine years ago, the specialty being textile machinery, and the son was connected with the shop most of his life. In later years he had become noted, at least locally, by his passion for outdoor life.

Russell W. Davenport, general manager of the William Cramp & Sons Ship and Engine Building Company, died in Philadelphia, March 2, fifty-five years old. Mr. Davenport was a graduate of Yale. At one time he held an important position at the Midvale Steel Works and later had been general manager of the Bethlehem Steel Works. He was one of the best known authorities upon the manufacture of steel, especially for guns and armor plate.

John S. King, treasurer of the David Williams Company and business manager of its publications, the *Iron Age*, the *Metal Worker* and *Carpentry and Building*, died in Brooklyn, March 4, sixty-two years old. Mr. King, born in Middletown, N. Y., began life as a printer and saw service in the Civil War. He came to New York in 1868, and the next year became business

manager of the *Iron Age*. In 1898, when the David Williams Company was formed, he was made treasurer.

New Catalogs.

Jeffrey Manufacturing Company, Columbus, Ohio. Screening machinery; catalog No. 69; well illustrated by half-tones and drawings. 6x9, pp. 56, paper.

Superior Tap Company, Springfield, Vt. Catalog and price list of the Standard taps made by this company. Series A. Illustrated. 5x7, pp. 27, paper.

The Norwalk Manufacturing Company, Norwalk, Ohio. "Standard" bolt cutters, illustrated by photographs and sectional drawings. 5x8, pp. 10, paper.

We have received from the Link-Belt Engineering Company, Nicetown, Philadelphia, a circular devoted to link-belt case-hardened sprocket wheels. Illustrated.

D. E. Whiton Machine Company, New London, Conn. We have received from this company a folder describing the Whiton two-spindle centering machines. Illustrated.

New Corporations

United Electrical Manufacturing Company, New York city; capital, $50,000. Directors: E. F. Buchanan, A. O. Brown and L. G. Young, New York.

Royal Machine Company; capital, $40,000. Incorporators include Julius C. Liebhardt, Newark, N. J.; William J. Morrissey, New York city.

Jordan Automatic Signal Company, New York city; to deal in electrical signals. Incorporators and directors for the first year: Wm. H. Jordan, C. C. Jordan, J. F. Jordan, all of New York city.

Common Sense Journal Packing Company, Camden, N. J.; capital, $250,000. Incorporators: A. J. Sanborn, Frederick G. Dussonias, James F. Cotter.

Third Rail Safety Signal Company, New York City; object includes obtaining a patent relating to electric signaling; capital, $25,000. Incorporators: Otto Ernst, Larchmont, N. Y.; A. Parker Nevin, New York city, *et al.*

New York Scale Company, New York city; objects, to lease and sub-let scales, etc.; capital, $200,000. Incorporators: L. D. Wildman, William H. Pritchard and Frank Fowler, all of New York city.

Hazelton & Donald Machine Company, Camden, N. J.; objects, mechanical and electrical engineers and toolmakers; capital, $50,000. Incorporators: Frederick D. Hazelton, Andrew Donald and James Donald.

Globe Electric Company, Camden, N. J.; objects, electrical machinery, etc.; capital, $100,000. Incorporators: William Eglin, James E. Hays, *et al.*

Marine Engine & Auto Motor Company, Wilmington, Del.; capital, $500,000. Incorporators: J. L. Westcott and Charles A. Gallagher, Camden, N. J.; H. A. Schoonmaker, D. Z. Evans, Jr.; T. K. Cheyney and Wm. A. McCowen, Philadelphia, Pa.

Monarch Machinery Company—Capital, $50,000. Incorporators: Frank A. Field, Fleetwood D. Van Atta and Mary L. Fleishmann, New York city; Charles F. Deitz, Slingerlands, N. Y.; Chas. S. Deppe and Philip L. Garrett, Dalmatia, Pa., *et al.*

Genesee Auto Car Company, Rochester, N. Y.; objects, manufacture gasoline motor cars; capital, $10,000. Incorporators: Ed. A. Keenan, Geo. W. Mason and H. H. Kingston, all of Rochester.

Shedd Electric Company, Roselle Park, N. J.; objects, manufacture electric novelties; capital, $250,000. Incorporators: J. Foster Symes, H. Richmond Palmer, N. C. Henshaw, C. A. Matthews and William H. Peck, all of New York.

Cooley Electric Process Company; capital stock, $500,000; president, J. F. Cooley, Boston, Mass.; treasurer, Robert Cushman, Boston, Mass. Directors: As above and W. C. Gray and H. T. Bradley, Boston, Mass., and E. C. Langton, Kittery, Me.

Phoenix Steel & Wire Company, Camden, N. J.; capital, $35,000. Incorporators: J. E. Higgins, J. F. Broughton and John A. MacPeak.

Bonnell Valve Company; to manufacture a back-pressure device patented by William Bonnell; authorized capital, $10,000. Incorporators: H. A. Rath, J. Meloth, F. B. Hetzman, William F. Rath and W. Bonnell. Incorporated in New Jersey.

Manufacturers.

Milwaukee, Wis., is planning to add to its North Point pumping station.

Fredericksburg, Va., is considering the enlargement of its water works.

The plant of the Waterloo (Ia.) Wagon, Buggy & Omnibus Company has been burned.

The Watertown (N. Y.) Gas Light Company will erect a new gas plant next summer.

The large plant of the National Brass & Iron Works, Reading, Pa., has been damaged by fire.

Mill No. 3 of the New York Mills, cotton goods, New York Mills, near Utica, N. Y., has been burned.

The Moline (Ill.) Scale Company has let the contract to erect a new shop, 72x185 feet, two stories.

The Garwood (N. J.) Foundry & Machine Company is erecting an additional factory building, 50x80 feet.

A factory of the Waukegan (Ill.) Sugar Refinery Company has been destroyed by fire and will at once be rebuilt.

Sloan & Co., manufacturing jewelers, Newark, N. J., will erect a two-story and basement, 90x100-foot factory building.

Colonel S. G. Grimshaw, of Houston, Tex., is quoted as saying that a Kaolin factory will be built at Flatonia or La Grange.

The contract has been let to erect a large new building for the barrel factory of Kimball, Tyler & Co., at Baltimore, Md.

Four new buildings will probably be erected at Leroy, Ill., by the proprietors of the Bloomington (Ill.) Canning Company.

It is expected at Muncie, Ind., that the Hixon Bedstead Company will add to its lines of manufacture and enlarge its plant before long.

Plans and specifications are being arranged by the Delaware & Hudson Railroad Company for the proposed erection of car shops at Wilkesbarre, Pa.

An addition is planned by the United Illuminating Company, New Haven, Conn., and a 300 horse-power engine is to be replaced by a 500 horse-power.

Alfred Box Company, manufacturer of cranes, Philadelphia, will erect a girder shop and a crane runway, covering an area 107x150 feet, at its plant.

The contract has been let to erect a four-story factory building, 40x215 feet, in Baltimore, Md., for Samuel Ales, to be used for the manufacture of pottery.

The Davis Mills, Fall River, Mass., have been considering a proposition to increase the capital from $500,000 to $600,000 in order to increase the spindles to 50,000.

Members of the Great Western Lime Company, which is composed of Chanute (Kan.) men, have induced the location near there of a cement plant by Chicago capitalists.

It is stated at Chester, Pa., that Joseph Blythe, inventor of an electric alarm clock, is awaiting a patent. He has received an offer from a capitalist to build a plant.

The work of building the big iron foundry for Babcock & Wilcox Company, boilermakers, at their plant in Bayonne, N. J., is practically finished. The machinery is arriving.

The Gas Appliance Company, manufacturer of gas generators, has arranged to install machinery and establish offices at 91 Campau street, Grand Rapids, Mich., we understand.

The Standard Turpentine Company is to erect a $50,000 plant at Savannah, Ga. It manufactures pine products under a patent process and already has a plant at Waycross.

The Maryville woolen mills property has been purchased by R. H. Hanna, proprietor of the Anchor Woolen Mills, Maryville, Tenn., who will consequently make certain factory changes.

Property has been purchased for manufacturing purposes at Normal, Ill., by capitalists who propose to make a solar and gravity power engine invented by Rev. Rollin C. Ogburn, previously of Lewistown, Ill.

At Oneida, N. Y., it is stated that Herman M. Reynolds and William E. Sherwood have formed a copartnership for the manufacture of wringers, and the plant will be located in the Reynolds block, on Phelps street.

Work on the new 150x57-foot foundry of the Burns Boiler & Manufacturing Company, De Pere, Wis., will be resumed as soon as spring opens. It will be equipped with electric crane and other modern appliances.

The Schmitt & Henry Manufacturing Company, Des Moines, Ia., manufacturer of mattresses and springs and wholesalers of furniture, will erect an additional four-story building, 113x132 feet, for factory and other purposes.

The Canada Corundum Company, Ltd., Toronto, Canada, producer of Craig Mine crystal corundum, has been builing a new mill, to have a capacity of 5,000 to 8,000 tons per year of finished product. The mill was to arrive at completion by February 15.

The Rockmart (Ga.) Stove & Foundry Company has been organized. The president is Jas. Long; vice-president, L. Kimball, of Atlanta; secretary and treasurer, Henry A. Powers, now or formerly of Rome. The machinery and patterns have been bought.

The Farnumsville cotton mills at Farnumsville, Mass., have been sold at auction to C. Lambert, of Dexter, Lambert & Co., New York city, and Paterson, N. J. It is understood that he will immediately install machinery for the manufacture of silk goods.

From Cleveland, O., is reported the incorporation of the Republic Building Company (capitalization, $500,000) by V. M. Moore, J. E. Sawhill, A. M. Hopkins, W. W. Tremaine and Z. T. Armstrong. It is proposed to erect one or more large power buildings.

Butler Brothers, the notions and general store supply concern, 495 Broadway, New York city, have acquired twenty-eight lots in the manufacturing district of lower Jersey City, N. J., and plans have been drawn for a five-story building that will cover the whole site.

B. G. Hudnut, of Terre Haute, Ind., owner of the Citizens Street Railway Company, of Vincennes, Ind., will make improvements, consisting of new power-house and other improvements in the line with an expenditure of $50,000 to $75,000, the coming spring months.

Sub-bids are said to have been invited for a six story and basement factory, 93x81 feet, to be built at the southeast corner of Thirteenth and Hamilton streets, Philadelphia, for Williamson Bros. & Co. This presumably refers to Williamson Bros. Company, iron works.

The People's Rapid Transit Electric Railway Company has just been incorporated, and it is likely to build a power-house at or near Celina, O. T. Rhys Smith, of New York city, is chief engineer, and recently visited Celina looking for a site, in company with Engineer Chas. M. Smith, of that place.

The directors of the Landis Tool Company, Waynesboro, Pa., have determined to build an addition to the west end of the present large shop, to be used as a blacksmith shop. Many inquiries are being received for the new bolt cutters to be made by the company. The machine will soon be ready for the market.

A tract of land has been purchased at Lyndhurst, Bergen County, N. J., by a manufacturing concern which has headquarters in New York city, and it is announced that a plant will be built for the production of office furniture, built with patented steel frames. B. A. Beckwith is president of the company.

As a result of negotiations between Secretary H. H. Vogt of the Davenport (Ia.) Business Men's Association and representatives of the Pennsylvania Automatic Pump Company, it is expected that the latter will remove its manufacturing plant to Davenport from its present location in one of the suburbs of Pittsburg, Pa.

It is stated at Waukegan, Ill., that the new United States Envelope Concern is to build its factory under the name of the Waukegan Realty Company. The contract has been let to the C. Everett Clark Company, of Chicago. The factory and equipment will cost some $150,000. It will be 120x300 feet with a power-house, 26x63 feet.

The International Machine Company has been formed by F. E. Hook, of Hudson, Mich.; A. K. Keller and Dr. J. C. Johnson, of Adrian, with a capital stock of $50,000, and will manufacture the new machines for the construction of the "Holdfast" wire fence. Work is being done at the Kells Foundry & Machine Company's plant, Hudson, Mich.

It is stated at Washington, Ind., that a new factory may be erected near Monroe City, Ind., to manufacture inventions of Rev. James M. Stafford, who has secured patents on a non-refillable bottle, an electrical machine, etc. He has formed a stock company and proposes to erect a factory near his home in Harrison township, providing the Vincennes & West Baden traction line is built.

The Jackson (Mich.) Cement Sewer Pipe Company (capital, $100,000) has been formed to manufacture machines for making pipe of cement strengthened with metal, as well as the pipe itself. Edward F. Lowery is president; John M. Phalen (a machinist, of Jackson, one of the inventors), vice-president, and Andrew J. Meade, secretary and treasurer. It is proposed to establish a plant at Jackson.

Geo. V. Cresson Company, Philadelphia, Pa., has acquired the patents and exclusive right to manufacture and sell the simplex variable-speed countershaft formerly marketed by the Speed Control Company, of Philadelphia. They have redesigned and greatly improved the device, which is to be known hereafter as the Cresson variable-speed countershaft. It will be made from 1 to 150 horse-power.

Patterson, Gottfried & Hunter, Limited, machinery, metals, hardware, tools and supplies, 146 Centre street, New York, have recently made an arrangement with Brown & Wales, of Boston, Mass., by which that firm will henceforth act as the sole representatives in Boston of Patterson, Gottfried & Hunter, Limited, and will carry there a large stock of Shaw patent compression couplings, Johnson safety shaft collars, B. & C. friction clutches, Robinson angle drives and National hangers.

The Alabama Phosphate Company (capital, $450,000) has been formed and secured land at Montgomery, Ala., for a large fertilizer plant, which will be driven by electric power from a station on the Tallapoosa River. J. H. Carpenter and J. W. Howard, prominent phosphate manufacturers of Columbia, Tenn., are president and vice president, respectively. R. J. Chambers represents them at Montgomery. The plans have been drawn by Peter S. Gilchrist, of Charlotte, N. C., a chemical engineer.

Applications have been made in Harrisburg for two charters by interests identified with the Pittsburg (Pa.) Steel Company. They are the Pittsburg Patent Company, organized as a holding company for certain patents, and the Seamless Tube Company of America. The latter, it is expected, will develop patents held by the first company and build a tube works, presumably in conjunction with the present steel works at Monessen, for the manufacture of steel tubes by a new and economical method. The incorporators of the new companies are the same, being Wallace H. Rowe, John Bindley, Edwin Bindley, Emil Winter and Willis F. McCook.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

J. Gregory, 140 W. 23d st., New York, specialist in small machine designing.

Wanted—Double action and dial feed presses. C. A. Bailey, Cromwell, Conn.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Patented specialties of merit. Address Power Specialty Co., Buffalo, N. Y.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—Specialties to make, either in metal or wood; best of work and prices. Sauls Brothers, Columbus, Ga.

Wanted—Copy January 11, 1900, AMERICAN MACHINIST; state price. Morgan Construction Co., Worcester, Mass.

Special machinery for reducing labor and increasing profits, designed and perfected. C. E. Sargent, M. E., 1214 Manhattan, Chicago.

Wanted—The address of parties manufacturing lever friction clutches with wood shoes, for gas engines. Address Box 518, Marietta, O.

We will buy, pay royalty or manufacture for patentee a patent possessing merit; light machine work solicited at reasonable prices. Box 208, AMERICAN MACHINIST.

We desire an agent in every shop in the United States to handle our technical books; a wide-awake man can do very well; only one in a shop. The Derry-Collard Co., 256 Broadway, New York.

Want to furnish men of proved ability, as managers, superintendents or foremen, in the metal-working industries; no charge; also want men to fill such positions. For terms address James Brady, Room J, 20th Floor, 220 Broadway, N. Y. City.

Well-known designer and shop manager wishes associates with capital to build a fully developed and highly successful machine tool; good profits, based on actual knowledge of costs—no guesswork—can be shown. Address Box 153, AMER. MACH.

For Sale.

For Sale—The patent for a first-class vaporizer, especially adapted for launch work; will make the price right. G. F. Dyer, Manchester, Mass.

Boring and Turning Mill.—Second-hand 8 ft. boring and turning mill for sale at a bargain. For particulars address Chuse Engine & Manufacturing Co., Mattoon, Ill.

For Sale—Four complete sets of patterns with all drawings for large machine tools; will be pleased to correspond with parties wishing to take up a good line. Box 442, AMERICAN MACHINIST.

For Sale—First-class patented lathe tool for relieving milling cutters, with drawings and jigs for making same, and twenty finished tools and others partly finished. Address Box 210, AMERICAN MACHINIST.

For Sale—Two direct-connected electrical generating units made by American Engine Co.; nearly new; replaced by larger; 50 K. W. each, 250 volts direct current. Manganese Steel Safe Company, 253 Broadway, New York.

For Sale—A machine shop in New York city (Manhattan); suitable for special machine building, automobile and general repair work. Established three years. Fully equipped with modern tools, all in first-class shape. Good location. Address R. C. Handloser, M. E., 127 Duane st., New York.

For Sale or Rent—Factory building, well located, in a good manufacturing town of about 5,000; about 8,000 square feet floor space; equipped with 12 H.-P. new gasoline engine and line shafting complete; nicely arranged offices in connection; will rent for long term, or sell for part cash and take stock in good company for balance. For further particulars address P. O. Box 22, Shelby, O.

Manufacturing Plant for Sale.—We offer for sale, or lease if desired, the plant at the corner of 12th and French streets, which we are now vacating for our new works on the western city limits; equipped with power, cranes, tool foundations, shafting, hot air heating system, electric light plant, etc.; foundry in connection; suitable for medium or heavy manufacturing. Address Ball Engine Co., Erie, Pa.

For Sale—New and second-hand machinery, consisting of 1 Gould Centrifugal Pump, 1 27 in. Boston Forge, 1 Power Feed Cutter, 1 18 in. Filter Press, 1 Pigs Foot Machine, 1 Bullock Engine, 1 R. & W. Osc. Engine, 1 Remington Ice Machine, 1 Corliss Engine, 1 Hughes Single-Acting Air Pump, 10x9x10; 1 Deane Single-Acting Vacuum Pump, 6x8x10; 1 Smith-Vaile Single-Acting Pump, 7½x7½x10; 3 Demming Rotaries, 2½x2; 1 Knowles Single-Acting Pump, 4x3½x5; 1 Irven Van Wie Centrifugal Pump, 2½x2½; 1 No. 4 Weir & Creig Centrifugal Pump, 6x4, and many other bargains suitable to various purposes. Write for complete list. Swift & Co., Purchasing Department, Union Stock Yards, Chicago, Ill.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

FLORIDA.

Draftsman; young man with shop and drafting-room practice in marine and general work; want to change; North or West preferred. Box 250, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical draftsman wishes to change. Address Box 255, AMERICAN MACHINIST.

A draftsman, college graduate, 2 years shop, 5 years drafting room; experience in hydraulic and conveying machinery, elevators, presses. Box 232, AMER. MACHINIST.

Wanted—Position of responsibility, by

young man; 13 years' shop and drafting-room experience; up to date on appliances for turning out work rapidly; understands handling men. Box 536, AMER. MACHINIST.

NEW JERSEY.

Position wanted by experienced foreman, about 40, accustomed to handling men and building and erecting special machinery. Box 245, AMERICAN MACHINIST.

Foreman of machine department wants position; 20 years in machine shop; experienced in handling men; best of references. Box 214, AMERICAN MACHINIST.

Wanted—Position in drawing room under instructions; 2 years' shop experience and 2 years in drawing room; opportunity of greatest importance. Address Box 238, AM. MACH.

Mechanical, electrical and marine engineer, Cornell graduate, desires engagement; especially qualified in power plant, marine and high-speed engine and boiler design, erecting, testing and inspecting. Box 240, AM. MACH.

NEW YORK.

Machine designer, 10 years' practical experience, wants position. Box 220, AM. M.

Mechanical draftsman, 26 years old; supplies and steam engines. Box 256, AM. M.

Superintendent, thorough mechanic, desires change; A1 references. Box 244, A. M.

Mechanical draftsman with some structural experience wants position. Box 253, AM. M.

Energetic salesman, age 28, thorough, practical man, wishes to connect with machinery house; trustworthy and reliable. Box 239, AMERICAN MACHINIST.

Draftsman.—Mechanical draftsman wants position; 10 years' experience on valves and fittings for water, gas and steam. R., care AMERICAN MACHINIST.

Young man of executive ability, mechanical training and who has had considerable experience as cost accountant, desires situation. Address "Capable," Box 246, AM. M.

By technical graduate, 6½ years' experience in design of engines, pumps and heavy machinery, also boiler and furnace construction and in managing business and selling; accustomed to responsibility and handling men. Box 252, AMERICAN MACHINIST.

OHIO.

Designing draftsman, expert on Corliss engines, familiar with pumping and blowing engines, general machinery and power plant equipment, years of experience and up to date, is open for engagement. Box 204, A. M.

Wanted—Position as superintendent or chief draftsman, by a practical mechanical engineer; 32; technical education; experienced in simple and compound engines and general engineering. Address Box 229, A. M.

PENNSYLVANIA.

Draftsman-designer, 7 years' experience in steam engines, also shop practice, desires position; age 25. Box 249, AMER. MACH.

Mechanical engineer on general work wants position as assistant superintendent or chief draftsman. Box 235, AMERICAN MACHINIST.

Who speaks first for the services of the man you need in your business? Experienced mechanical engineer with originality and push, thorough knowledge of advertising and business systems, desires to meet the man who needs him most. Address "Energy," care AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Several first-class machinists and toolmakers; good wages paid the right men; apply at once. Ross Rifle Co., Quebec, Canada.

GEORGIA.

Wanted—With experience on M. E., draftsman, estimate clerk on boiler and engine and building work, also on general machine work. G. R. Lombard, Augusta, Ga.

ILLINOIS.

Wanted—Two telephone switchboard draftsmen; experienced; Chicago company. Box 248, AMERICAN MACHINIST.

Wanted—Two good electrical-mechanical draftsmen; none but men with experience need apply; state age, education, experience and salary expected. Box 247, AM. MACH.

Wanted—A1 tool steel salesman; one able to demonstrate high-speed steel; state age, salary and references, also about what trade in command; all letters strictly confidential; A1 man only. Box 234, AMER. MACHINIST.

Young man for assistant to sales department manager; must have business ability and technical knowledge, especially steam engineering, fitting him to attend to correspondence, etc.; location, Chicago. Box 254, A.M.

We are constantly increasing the scope of our work and invite applications for positions from first-class patternmakers, molders and core-makers; we always have vacancies. Address Allis-Chalmers Co., New York Life Bldg., Chicago.

INDIANA.

Wanted—Experienced foreman for machine shop to manufacture automobile gasoline engines; good wages with advance; will give interest in business, which is well established. Box 222, AMERICAN MACHINIST.

MASSACHUSETTS.

Wanted—An expert toolmaker; one accustomed to backing off cutters preferred; state terms and experience. Address Boston Gear Works, Boston, Mass.

Wanted—By a machine shop situated in eastern Massachusetts, a number of good, all-round machinists on jobbing and special machinery; men who can handle this work satisfactorily will receive good pay and steady work; give age and experience. Box 243, AMERICAN MACHINIST.

NEW JERSEY.

Wanted—Foreman for a foundry in New Jersey employing about 20 molders and making castings up to 3 tons each; must be sober, reliable, up in modern practice and able to produce sound castings at a minimum cost; state age, experience, salary and references. Address Box 236, AMERICAN MACHINIST.

Wanted—General foreman for a machine shop located in New Jersey, employing 150 men, constructing machinery of medium weight; must have experience in modern methods, speeds and feeds; able to hire and control men to the best advantage and to produce machinery of high grade at a minimum of cost; only capable men need apply; to insure attention, state age, salary, experience and references. Address Box 237, A. M.

NEW YORK.

Wanted—A first-class toolmaker and all-around machinist. Write, giving experience, etc., McEwen Bros., Wellsville, N. Y.

Wanted—Experienced salesman to take a specialty being introduced to machine shops and other manufactories; may be taken as a side line. Address Box 211, AMER. MACH.

Wanted—Wood-workers capable of making tonneaus and bodies for automobiles; good pay; steady work; only competent men need apply. Address Box 242, AMER. MACHINIST.

Wanted—A good hammer man for drop forgings; automobile and other light work; good pay; steady work; only competent men need apply. Address Box 241, AMER. MACH.

Wanted—First-class draftsman and designer, familiar with hydraulic elevator work, immediately; state salary desired, also furnish references. Address Superintendent, care Howard Iron Works, Buffalo, N. Y.

Wanted—Mechanical draftsmen, experienced in shop practice and designing special machinery; none others need apply; state experience; good positions for the right men. Address A-961, care AMERICAN MACHINIST.

Wanted—Competent engineer, capable of taking complete charge of buildings and power plant of large manufacturing company in vicinity of New York city; state experience and references. Address M. S., care AM. M.

First-class salesman to sell tool steel, having had 5 years' experience in selling tool steel, also a practical knowledge in working same; give full particulars, references; state salary expected and territory covered. Address "Tool Steel," Box 257, AMER. MACH.

OHIO.

General foreman, experienced in building high-grade machine tools; state age and salary expected, with references. Box 209, AMERICAN MACHINIST.

Wanted—Draftsman and designer on a general line of sheet, stamping and bar metal working machinery and tools; excellent opportunity; permanent position to right party; do not apply unless thoroughly competent. Box 180, AMERICAN MACHINIST.

PENNSYLVANIA.

First-class, experienced, mechanical draftsmen wanted at once by an old-established, large concern; those familiar with steam or gas engine design and with shop experience preferred. Apply by letter to "Chief Draftsman," care AMERICAN MACHINIST, stating experience in full and giving reference.

Draftsman—Young man of good character and ability, with recent experience on modern high-speed engines; a very desirable and permanent connection awaits a man who can demonstrate his ability and worth; to receive consideration, give full details, experience, where employed past and present and salary received; all communications confidential. Box 251, AMERICAN MACHINIST.

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Screw Milling Machines.*

BY H. LIEBERT.

In the first instance this machine was made for machining very cheap screws, such as ventilator, chair, press, and cork-drawing machine screws. In bringing it out I of course knew that it was not possible to mill square threads theoretically true. But it appeared to me from experience that a machine could be produced to make good and salable screws cheaply and of such a quality as to command a good market. It was my idea at the time to manufacture screws, not to sell the machines.

As regards the construction of the machine, the first machine I made was in many respects different from the present one. In the first machine I followed out the principle of the lathe, namely: letting the cutter-head and the stay† travel with the carriage, keeping the work longitudinally between the centers and only revolving it. In using the machine it was found, however, that this method had a great many disadvantages, and it therefore became necessary to design a second machine, which, as shown in Fig. 1, consists of a short bed about 5 feet long, mounted on a tray and legs, the former catching and returning all the lubricant to the pump and tank situated at the back of the machine. At the right-hand end of the bed is a universal headstock *B*, which has three adjustments, a rotary and cross adjustment which gives the cutter its proper angle and position for cutting either right or left-hand threads, and a vertical adjustment for regulating the depth of cut. All these adjustments are controlled by indexes, and the vertical movement has in addition a quick withdrawing motion *E*, which can be operated without altering the depth of cut. The vertical slide *A* has also a stay *C* with lock-handle *D* to give it additional support.

The auxiliary spindle is driven by a cone pulley with two speeds 7 inches and 5½ inches, respectively, with a 2-inch belt, and drives by means of gun-metal or hardened steel gears the cutter spindle, which is of steel and hardened, and runs in hardened conical bearings which are adjustable for wear. A good tail-pin is also provided to take the angular thrust. The cutter mandrel is solid with the spindle.

At the left-hand end of the bed a bracket *F* is fastened, carrying a hollow tube *K* and the two dividing disks *G* and *H* for cutting multiple threads. This arrangement when the disks are disconnected by putting the catch *L* out of use enables the hollow tube *K* to be revolved with its disk *H*, without revolving the disk *G*, which is keyed to the change wheel *O*. Through the dividing disks and gear wheel *O*, connected by a sliding key, runs the hollow tube *K*, which gives the work its rotary motion. The front end of this tube is carried by a sliding bracket *M*, which is connected by an adjustable nut *N* to the guide screw, and receives from this its forward motion, the two motions being connected by quadrant plate and change wheel, which enables the pitch of the work to be altered as desired.

This guide screw [lead screw] is driven from the end of the bed by a cone pulley *R*, and has an automatic stop motion and a quick return by power, also hand adjustment by hand-wheel *S*. The work, which is held at one end by the chuck *P*, is supported under the cutter by the stay *Q*. This stay *Q* is merely a V-block, made of cast steel and hardened, and vertically adjustable for the different diameters of screws to be cut. The stay is also provided with an automatic arrangement for cutting screws right up to the shoulder.

The work is held down in its proper place in the V-block by a lever *B*, Fig. 2, which is actuated by an eccentric shaft *U* by means of the handle *T*. The stay *Q* forms part of the slide *V*, which carries an ordinary compound slide rest with a quick withdrawing motion. This compound slide rest is only attached when specially desired. It is, however, an ex-

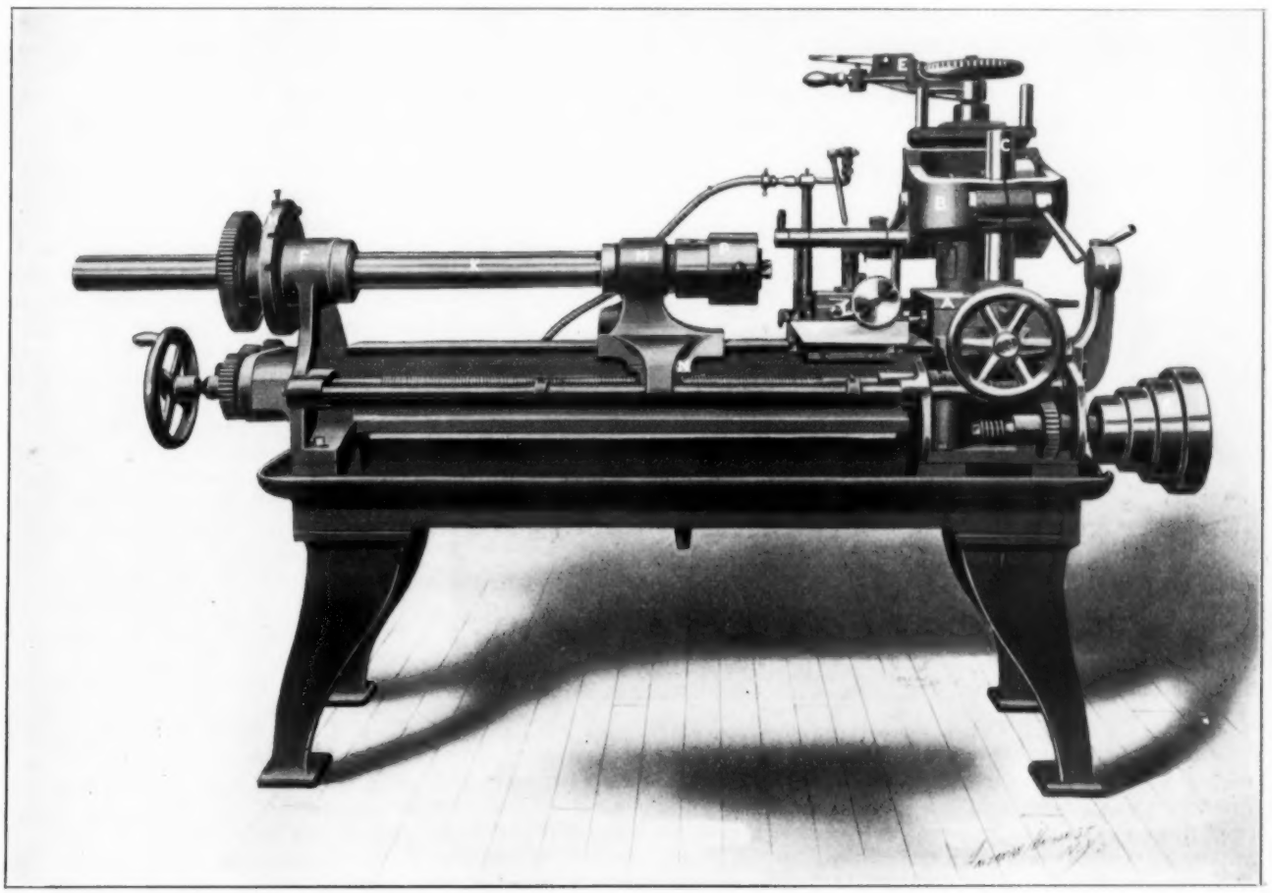


FIG. 1. THREAD MILLING MACHINE.

*Abstract of a paper read before the Manchester Association of Engineers.

†The term "stay" appears to be here used in a sense equivalent to both the American terms center-rest and follow-rest.—ED.

ceedingly good arrangement to control the wear of the cutter. I use this compound slide rest specially on the machines for cutting armor-plate bolts.

The wear of the cutter is controlled in the following manner: Armor-plate bolts have a round thread, and the cutters used are backed-off cutters. When the cutter has just been ground and starts on the work, the tool on the compound slide rest being the exact shape of the cutter does not cut. If, however, the cutter gets blunt or wears, the tool starts cutting and shows the operator that his cutter requires grinding for the next bolt he puts on.

Perhaps the working of the machine may be better understood by describing how a piece of work is operated upon. A cutter of the correct size, 2¾ inches diameter, is put on the spindle. The cutter head is then set to the right angle, and in the center of the work. The correct change wheels are put on the quadrant plate for the correct pitch. The headstock is regulated for depth, the work fastened

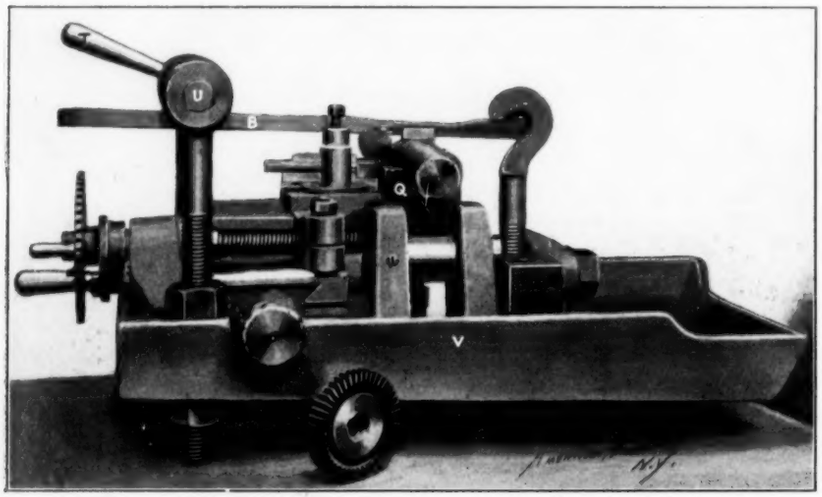


FIG. 2. WORK SUPPORT AND COMPOUND REST.

in the chuck resting at the end to be cut on the stay *Q*, and being held down by the rod *B*, Fig. 2, actuated by the eccentric. The machine is then set in motion and work begins.

The cutter takes out the full depth of thread at one cut; the work revolves and feeds forward until the required length is cut, when the machine automatically knocks off. The cutter is then raised by means of the quick withdrawing motion on the vertical slide, and also the turning tool is withdrawn if it has been in use. The eccentric for actuating the holding down rod is put out of action. The nut which feeds the work forward is put into the quick-return clutch by the rod along the front of machine. The work then starts traveling on the quick return, and automatically pulls the quick-return clutch out of gear, thus stopping the quick-return motion. The chuck is now slacked, the work taken out and a new piece inserted.

There is also shown in Fig. 1, at the headstock end of the bed a bracket *Y* which is used in cutting screws of long lengths. These are cut in the following manner: When the work has fed up the full capacity of the machine the end of the work which has been cut projects through the bracket *Y*, which contains a split bush with a hole the same diameter as the work itself. The lock-handle *A'*, fixed on the bracket *Y*, is then tightened, compressing the bush and gripping the work. The chuck *P* is then slackened and the carriage *M* run back, leaving the work held by the bracket *Y* and by the milling cutter, which has been stopped revolving and left down in position in the work. The carriage *M* then knocks off. The clutch is put into the forward feed, the backlash taken out of the wheels, and the chuck *P* tightened on to the work. The lock-handle *A'* is then slackened, and a fresh length of screw is ready for cutting.

The advantages of this second machine over the first one are as follows: The stay is entirely independent of the cutter headstock; the headstock is stationary, and can be firmly bolted down to the bed. The machine is provided with a hollow spindle, so that any length of screw can be cut. A compound slide rest can be added to control the wear of the cutter. The long and objectionable countershaft has been done away with.

As regards the cutting of multiple threads, this is accomplished in the first case by the dividing disks. When double threads only have to be cut, two cutters can be put on the mandrel at the same time, with a distance piece between the two cutters, the accuracy of the double thread being subject to the distance piece. The only disadvantage in cutting a screw in this way is that the nut will not run up quite so far as the threads are cut.

The cutter nearest the end of the mandrel ought really to go on working for half a revolution of the stock, while its fellow cutter ought to have lifted out of the work to allow the threads to finish opposite each other. As the cutters are now arranged they finish together, consequently half a revolution of the feed of the nut is lost.

A very good point about screws cut on the screw milling machine is that nuts will not lock on them, as the end of the cut is left to the radius of the cutter.

Coming back to the milling cutters, various kinds of cutters are used. First, my patent pressed steel milling cutters, which are cheap and very good for some classes of work, the teeth being staggered and coarse in pitch. They leave the work rougher on the sides of the thread than the ordinary cutter cut on three edges. Secondly, the cutter cut on three edges, which is more expensive in first cost and can be ground less times than the pressed steel cutters; so, in addition to being more expensive, they also have a shorter life, as against which, however, they produce better work. Thirdly, for worms and Acme threads a taper cutter is used cut on three edges and of a fine pitch. These cutters produce better work than backed-off cutters. They do not overtax the machine, and by using them a small machine can be made to do the work of a larger one, and this, if the maker of screws has only one machine, is at times very convenient. Fourthly, backed-off cutters* are used where the shape of the thread is composed of curves, such as armor-plate bolt threads or Whitworth V-threads.

As regards the life of these cutters, the following particulars may be interesting:

Two ordinary steel patent cutters, 2¾ inches diameter, running 600 R. P. M., cutting drawn brass screw ½ inch diameter, ½ inch lead, ¼ inch pitch, width and depth of cut 1-16 inch, feed 6½ inches per minute. These were ground once each week.

Two high-speed steel cutters cut on three edges, 2¾ inches diameter, running 200 R. P. M., cutting bright drawn screw 1 inch diameter, ½ inch lead, ¼ inch pitch, width and depth of cut ⅛ inch, feed 4 inches per minute. These were ground every eleven hours.

One ordinary steel cutter cut on three edges, 3¼ inches diameter, running 90 R. P. M., cutting mild steel screw 3½ inches diameter, 3½ inches lead, three starts, width of cut 9-16 inch, depth of cut 7-16 inch, feed 1¼ inches per minute. This was ground every five hours.

Two high-speed steel cutters cut on three edges, 2⅜ inches diameter, running 200 R. P. M., cutting bright drawn screw ⅜ inch diameter, ½ inch lead, ¼ inch pitch, width and depth of cut 1-16 inch, feed 4½ inches per minute. These were ground every nine hours.

One high-speed steel cutter cut on three edges, 2¾ inches diameter, running 1,700 R. P. M., cutting cast-brass screw 1 inch

*By "cutters cut on three edges" we infer the author to mean cutters of the usual form which are ground upon the edges and by "backed off cutters" to mean patent relieved cutters which are ground upon their faces only.—ED.

diameter, ¼ inch pitch, ¼ inch lead, width and depth of cut ⅛ inch, feed 60 inches per minute. There was no appreciable wear after the cutter had milled a gross of these screws, each 2 inches long.

Also two high-speed armor-plate bolt cutters made of Sir W. G. Armstrong, Whitworth's A. W. steel. One of the cutters making 160 R. P. M., cutting 6 inches peripheral speed, was ground every eight hours. The other, making 200 R. P. M. and cutting 12 inches per minute feed, lasted two hours.

As regards the pair of high-speed steel cutters, 2⅜ inches diameter, they have worked eight weeks continuously, have cut 3,000 feet of double thread. When new they were 2⅜ inches diameter, and have lost ⅛ inch diameter through grinding in eight weeks. The cutters are still in fair condition, and will no doubt do some more work.

Perhaps you will agree with me that this is a splendid result, and plainly illustrates that the cost of the milling cutters for screw milling machines is only a mere trifle in comparison to the amount of work they will produce.

I have also brought you the cutter, cut on three edges, made of high-speed steel, which has milled the gross of brass screws. These screws are for valve spindles. The actual time of cutting on each screw was 35 seconds. You will be able to judge for yourselves the condition the cutter is in. I myself cannot trace any wear on the cutter. The comparison between high-speed steel and ordinary steel cutters for the screw milling machines shows the following results: To cut a screw ½ inch diameter, ½ inch lead, 3-32 inch deep, 18 inches long, with ordinary steel, it would take 20 minutes; with high-speed steel, 15 minutes. Assuming the life of the cutters to be the same, we do one-third more work in the same time with a high-speed steel cutter than with an ordinary one. The high-speed cutters will stand running faster with more feed on for the same amount of grinding.

Of course you all know that it is quite impossible to cut a perfect square thread with a milling cutter. It appears at first sight that only one shape can be obtained by a square cutter. This, however, is not the case. The angle of the thread is different at the top from what it is at the bottom. If the cutter is set to the angle at the top of the thread a hollow section is milled. If set to the angle at the bottom of the thread a somewhat tapered section is produced. If, however, the cutter is set to the angle midway between the top and the bottom of the space the nearest approximation to a square thread is obtained, and the amount of variation may be easily seen from the wooden model I have prepared. Of course the model is on a large scale, and purposely exaggerates the errors so as to clearly illustrate the three forms of thread obtainable.

In ordinary commercial screws the variation from the square is almost imperceptible. Thus in obtaining the angle for milling a 1½-inch screw with two threads per inch, where the thread would be ¼ inch deep, it is necessary to assume the diameter of the screws to be 1¼ inches, which is the diameter midway between the top and the bottom of the threads. The angle for the top is 6 degrees, for the bottom 9, and midway between 7½. In cases where an absolute fit is wanted it is only necessary to cut the nuts with a tap that has been produced on a screw milling machine.

The taps are made in this way for cheapness of production. However, it has been found that it is not necessary to make them this way, as the result obtained by using ordinary taps cut in the lathe is all that can be desired. I may say, in order to uphold this statement, that a square thread screw for gun-carriage work, cut in the screw-milling machine in the ordinary way, passed the government gages, and such screws are being produced daily.

As regards the accuracy and quality of the work, the smoothness of the cut depends upon the rate of the feed in relation to the number of the revolutions of the cutter. By feeding slowly and increasing the revolutions of the cutter, I get the best results. The lines left on the sides of the thread are then very close together.

Respecting the width of the space, this is always very good, as the thread is cut

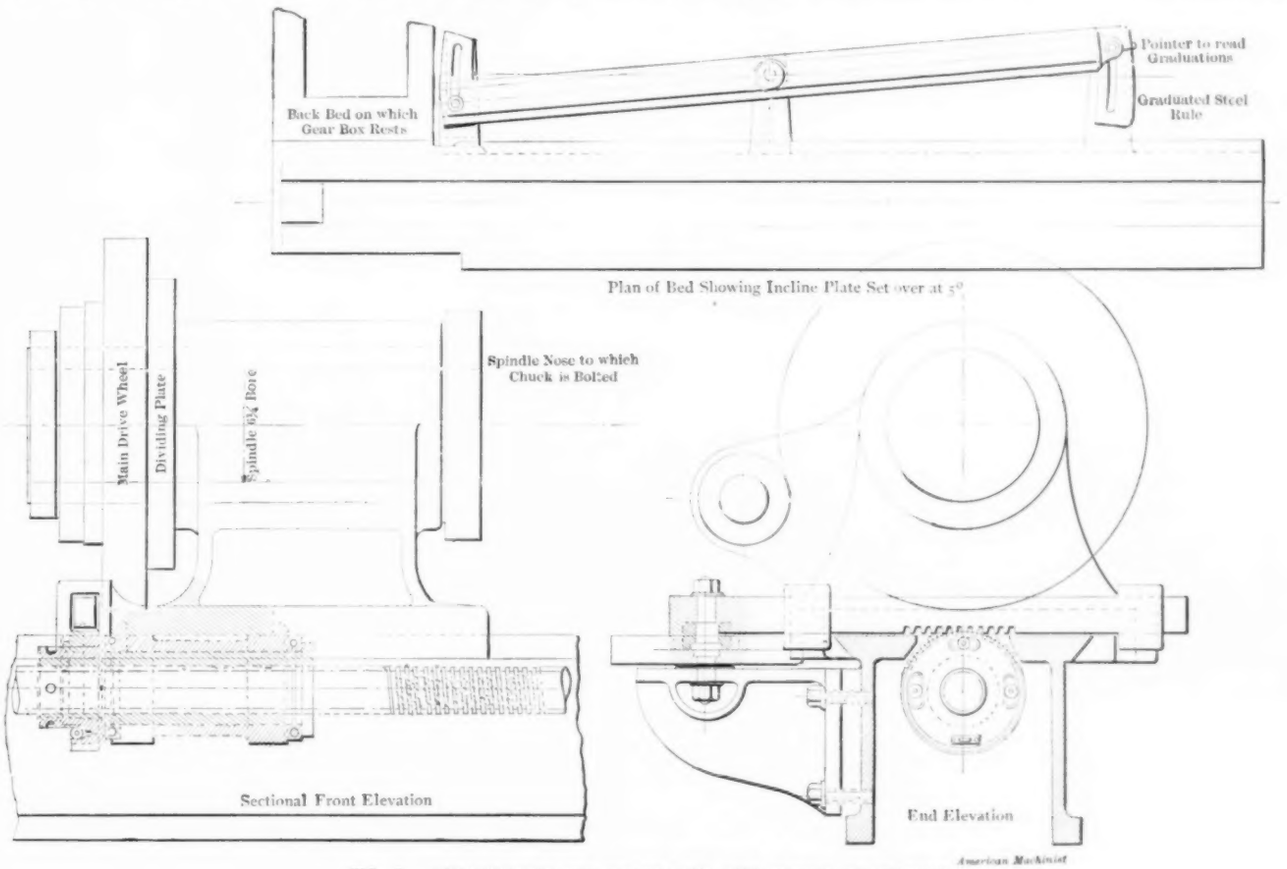

Pointer to read Graduations
Graduated Steel Rule
Back Bed on which Gear Box Rests
Plan of Bed Showing Incline Plate Set over at 5°
Spindle Nose to which Chuck is Bolted
Main Drive Wheel
Dividing Plate
Spindle 6¼ Bore
Sectional Front Elevation
End Elevation
American Machinist

FIG. 3. ATTACHMENT FOR CORRECTING THE EFFECT OF TORSION.

the full depth at one cut. The wear on the sides of the cutter is practically nil, the points doing all the work, and as, after milling a quantity of screws, the edges of the cutter may become slightly round, I mill the space slightly deeper to allow the cutter to leave a slightly rounded corner in the bottom of the space.

In the cutting of threads of accurate pitch through long lengths, the greatest difficulty has been experienced. In doing this work on a lathe the same difficulty is encountered, due to the heating and torsion. In my machine I have only to overcome the effects of torsion, as no heat is produced. The torsion in a lathe is of small moment, however, while in my machine, owing to the whole of the material being removed at one cut, it is very considerable.

The heating in a lathe is spread over the whole length of the screw, and is due to the friction of the stays and the tool. In the screw milling machine any heating that could occur would be purely local, and even this is prevented by a stream of lubricant, which is continually directed over the cutter and its work. The effect of torsion is to shorten the screws, and I found that this shortening was more accentuated with Acme or worm threads than with threads of square section, due to the greater grip the wedge-shaped cutter has on the screw. This grip is caused by the cutter milling a thread exactly its own shape, the whole of the cutting edge being in contact with the work.

Consequently, I found my screws always short in pitch. This difficulty has, however, now been overcome by a simple device, by means of which I can either produce a screw with a gaining or a losing pitch (see Fig. 3).

For this purpose the nut on the carriage is made to revolve, a pinion is attached to the nut and a rack is provided to gear into the pinion. On the end of this rack is carried a bowl which runs on a former-plate extending the full length of the feed movement of the carriage, the former-plate being fixed on the outside of the bed and capable of being set at an angle.

If the guide-screw moves the carriage 6 feet and the correcting or former-plate is parallel with the edge of the bed, and consequently the nut did not revolve, the screws cut would measure, say, 6 feet, less 10½ thousandths; but if I set the correcting plate at an angle, I could take up the 10½ thousandths lost by slightly revolving the nut and helping the carriage forward 10½ thousandths in 6 feet by the double movement of the guide-screw and the revolving of its nut.

The correcting arrangement is of the greatest importance, and for accurate screw cutting is an absolute necessity. You will thus observe that my machine is perfectly free from imperfections due to heating, which is an extremely variable quantity, and thus very difficult to compensate for. For government guide-screws an error limit of 1-100 inch in 4 feet is allowed, and great care has to be exercised in cutting screws within this limit; whereas in my machine, not having to contend with the variable effect of heat, but with a constant effect of torsion in the manner explained, it is perfectly easy to cut screws commercially well within the government limits.

Some of you will no doubt say that the torsion is not a constant effect, and you will be quite right in saying this, as it varies with the different materials; but as a firm uses the same brand of materials for its work and gets accustomed to the use of same, notes can be made, and we have found that by using the same brand of bright drawn, we have been able to cut six screws running well within the government limit, and, as far as we can tell, correct in pitch. For this purpose we did not even find it necessary to grind the cutter after cutting each screw.

As regards the cost of production, the particulars of three different months, taken from our piece-work book, are given. In the month of November, 1902, the amount of thread cut approximately was 15,800 feet, peripheral measurement, which is equal to about 3 miles, or a screw 1 inch diameter, ½ inch pitch, ½ mile long. The average number of machines working at the same time was five.

Calculated from the time booked, the average time of cutting for each of the five machines was 170 hours, so that the speed of cutting averaged 3.7 inches per minute measured on the periphery. Wages paid for dong this were £8 13s. 5d., and the above was made up of fifty-five different jobs; thus the cost works out at ⅛d. per peripheral foot.

The amount of thread cut in the month of July, 1903, equalled approximately 41,870 feet peripheral measurement, which is equal to about 7.93 miles, or a screw 1 inch diameter, ½ inch pitch, 1½ miles long. The average number of machines working at the same time was six. From time booked, the actual time of cutting was 195 hours for each machine, and the speed of cutting averaged 6 inches per minute measured on the periphery. Wages paid for doing this cutting were £13 10s., and the cost works out at .0774d. per peripheral foot, or 1-13d. The above was made up of 120 different jobs.

The amount of thread cut in the month of September, 1903, equalled approximately 30,000 feet peripheral measurement, which is equal to about 5.68 miles, or a screw 1 inch diameter, ½ inch pitch, .9 mile long. The average number of machines working at the same time was six. Calculated from the time booked, the average time of cutting was 168 hours per machine, and the speed of cutting averaged 5.95 inches per minute measured on the periphery. The wages paid for doing this cutting were £11 4s. 4d., and the cost works out at .089d. per peripheral foot, or 1-11d. The above was made up of 104 different jobs.

You will notice that there is some variation in regard to the speed of cutting. This is due to the class of work done, whether double or single thread, brass or iron, and whether many changes were made for different jobs, necessitating expenditure of time for setting the machines. We have seven machines in operation at our works, all seven being worked by the same hand, the man drawing, on the average £7 7s. 2d. per month, and the foreman turner who helps to do the setting of the machines and is responsible for the work turned out, getting a share of the piece-work balance earned by the man, which averaged £1 15s. 2d. per month in the three months referred to.

Factors of Safety as Factors of Laziness.

The following abstract of a paper by Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association, we take from *The Practical Engineer*, London:

Mr. Stromeyer mentioned that the term "factor of safety" must have been invented in the early days of modern engineering, when the public had to be educated into a feeling of confidence in iron structures which looked flimsy when compared with older ones of stone and wood. The term also served as a cloak for the want of knowledge among engineers as to how to determine stresses, and as to what their effect would be. We have certainly come down from the high factors of safety of seven to ten, and are content with five and four, and even less. These are nominal factors, and still cover much mental laziness which hinders us from examining structures in the light of many most beautiful and valuable investigations by mathematicians. The acceptance of a lower factor would entail considerable work of a highly mathematical nature, but it would permit many savings to be effected without in any way endangering structures. The author emphasized the necessity to consider the elasticity of structures, and instanced the case of change of material for ships from untested iron, which was considered to have a strength of 18 tons, to mild steel, which had to show at least 27 tons in the testing machine. Surely with an increase of 50 per cent. tenacity, or even more, the reduction of thickness of 20 per cent. which was then made was justified, but this reduction demanded a closer spacing of frames on account of springiness.

Regarding the harder qualities of steel, the author drew attention to the apparently simple case of the screwed breech piece of a gun, and showed that the number of threads may be reduced to a minimum only if the section of metal in the surrounding gun barrel is the same as that of the breech plug.

He next dealt with the question of live load, and lamented that most engineers

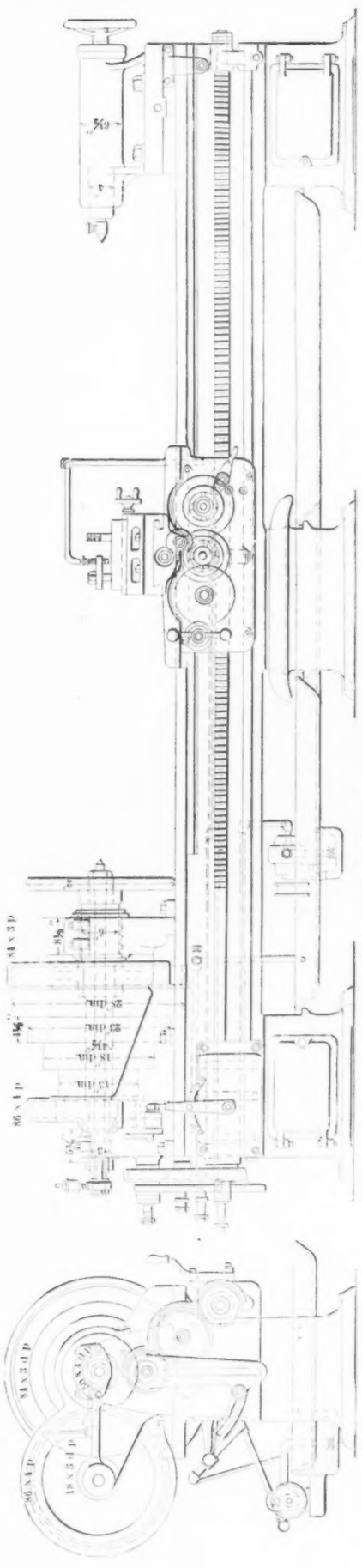


FIG. 2. 24-INCH ENGLISH LATHE FOR HIGH-SPEED STEEL.

still adhere to a view expressed many years ago by some professor, that load will produce twice as great a stress if moving as if resting. Ample mathematical inquiries are available for dealing with each case on its merits, and many cases ought long ago to have led engineers to deal with the matter in a more thoughtful way than merely using a large factor of safety, which was nothing else than a measure of ignorance. The author then dealt with the case of a bar striking an anvil, and showed how the stresses can be calculated.

He stigmatized much so-called practical experience as being nothing else but rule of thumb, the adoption of a factor of safety of five being of this class of experiences. The fault lay to a large extent with the physicists, who have not made the necessary experiments. He mentioned that, in addition to tension and compression stresses, there are seven compound stresses, of which only two have as yet received names, viz., hydrostatic pressure and shearing stress, and it is only the latter whose influence has been at all studied.

Concluding his remarks, Mr. Stromeyer pointed out that experiments are greatly needed, and that stresses in structures should be studied in fuller detail than is now customary. If that were done, the term "factor of safety," which he considered to be very undignified for engineers to rely upon, would gradually disappear; engineers would be able to say that a structure was safe as long as a certain load was not exceeded.

At St. Louis recently a large cofferdam of the Union Electric Company, built to retain the river water while a foundation was being laid, sprung a leak threatening to stop the work and cause serious damage. The engineer of the St. Louis Refrigerating & Cold Storage Company, being consulted, he promptly laid a lot of piping from his plant and froze up the leak, so that the foundation could be completed.

English Lathes for High-Speed Steel.

We illustrate herewith in half-tone, Fig. 1, and line engraving, Fig. 2, two sizes of a line of lathes intended especially for use with high-speed steel, which have been developed by Dean, Smith & Grace, Ltd., of Keighley, England. This firm turned their attention to this class of machinery immediately after the exhibition of the Taylor-White steel at the Paris Exposition of 1900, and the development has been such that they now make an exclusive specialty of it. The sizes for which they find the largest sale, and which consequently form the leading sizes, are of 8½, 12 and 16-inch centers, or, in American phraseology, 17, 24 and 32 inches swing. Our half-tone shows the 8½-inch (17-inch) and our line engraving the 12-inch (24-inch) sizes. Of these the first has a hollow and the second a solid spindle, as does also the 16-inch (32-inch) size.

The leading change by which additional power is delivered to the machines will be seen to be a widening of the shears

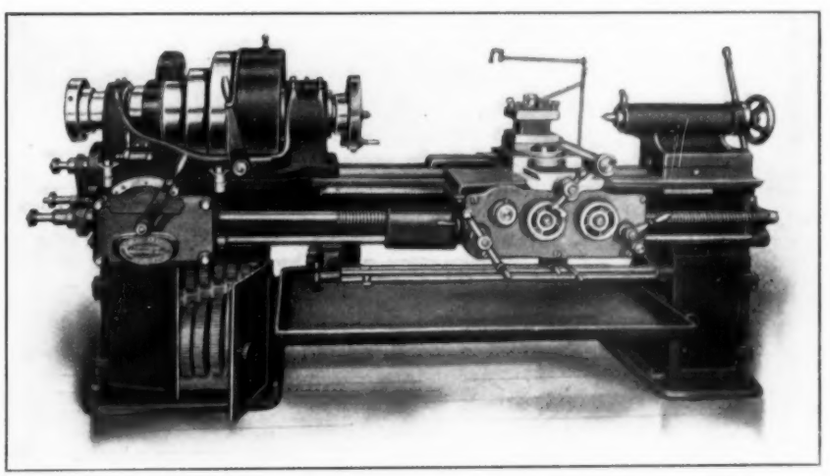


FIG. 1. 17-INCH ENGLISH LATHE FOR HIGH-SPEED STEEL.

and headstock, whereby an increase in the diameter of the cone pulley and main back gear is made feasible. The result of this is quite marked, the 24-inch lathe carrying a cone having its largest step of 28 inches diameter and a back gear of the same diameter. The countershaft of the smaller lathe is fitted with two speeds, giving the following speeds to the lathe spindle: 13, 18, 24, 33, 43, 60, 79, 110, 145, 200, 261 and 369 revolutions per minute; while for the 24-inch lathe the spindle speeds are 15, 25.8, 41.5, 70, 120.7, 203.4, 332.2 and 560 revolutions per minute, both of which lists are in close accordance with geometrical progression. The back gear ratios are respectively 6 and 8.

Owing to the high speed at which the cone pulley is operated, the centrifugal force is found to interfere with the lubrication of the cone bearings, and to provide for this, in the case of the solid spindle lathes, a hole is drilled from the rear end of the spindle past the bearings, from which oil holes lead the oil to the

bearings and a sight-feed lubricator at the end of the spindle supplies oil. The lubricating of the tailstock center, which has been found to give trouble, is provided for by drilling the center from the point and mounting a grease cup on it. This is shown only in the engraving of the larger lathe.

The lathes are fitted with pump and oil pan, and the feed rod worm is so arranged as to be automatically dropped out of gear at the end of the cut. It is also interlocked with the screw-cutting feed nut, so as to prevent the possibility of both gears being thrown into action simultaneously.

The 32-inch lathe (not shown) will remove a cut 1 inch deep under ⅛-inch feed and at 60 feet per minute peripheral speed, and under test, with one tool cutting, has removed 1,800 pounds of chips per hour. The 24-inch and 17-inch lathes will remove cuts of ½ inch deep by ⅛ inch feed and of ½ inch deep by 1-32 inch feed respectively, the peripheral speed being 60 feet per minute in both cases.

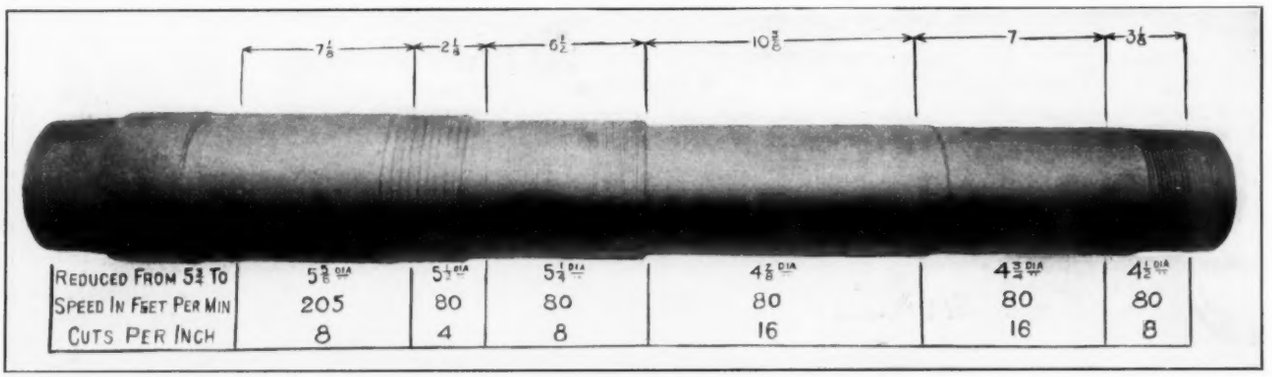


FIG. 3. WORK OF THE HIGH-SPEED LATHE.

These speeds are considerably exceeded under lighter cuts, speeds of 80 to 100 feet being common when rough turning steel forgings, while in turning shafting speeds of 150 to 250 feet per minute are used. In cast iron the speeds range between 60 and 80 feet per minute.

Fig. 3 shows a rough turned spindle for the 17-inch lathe, with data attached showing the performance of the 24-inch lathe on which the work was done, which from start to finish required twenty minutes, the material being forged steel of 20 points carbon and of 72,000 pounds tensile strength, and the work being done at a single cut for each step.

All work of this character is done in these works by rough turning and subsequent grinding.

The most powerful automobile up to date is said to be one made by M. Bellamy, of Paris. The engine is 165 horsepower, with eight cylinders and three forward speeds, the second of which is geared for 80 miles an hour.

As to Patents Which Obstruct.

BY HOWARD A. COOMBS.

I was much interested in reading the paper entitled "Patents Which Obstruct," by Mr. Geo. W. Dickie, which appeared at page 145. That there are too many of such patents cannot be denied by anyone familiar with the facts. The fault, however, is not so much with the patent system as with those who take advantage of it to further their own ends. Exactly similar arraignments can be and are made against every other branch of jurisprudence and against almost every branch of governmental activity. The object of the pension laws of the United States, for example, is high and noble, that of making slight return in the way of material comforts to those who suffered by sacrificing their personal interests to those of their country, and the opposition and objection which exist against the perpetuating of those laws comes entirely from the fact that individuals abuse them for their own interest. The same is signally true in regard to the statutes relating to corporations, crimes, claims against the government, the civil service, etc., as well as against the patent laws.

If the patent laws were construed and followed strictly enough to prevent the issue of any patent of doubtful validity which, in the hands of a wealthy corporation, might be used as a club against weaker competitors, the result would be that a large number of poor inventors, who might be unable to contest the question of patentability through the various tribunals provided for that purpose, would be materially and unjustly injured by the refusal of their patents, and the great utility of the patent laws is to enable the workingman to improve his position by the exercise of his ingenuity.

It was not, however, with the intention of writing a defense of the patent system of the United States that I took up the pen, but rather to call attention to certain parts of Mr. Dickie's paper which do not seem to me to be clear and which might even be misleading to those readers who are not personally familiar with the situation and the facts. And first I feel impelled to point out what seem to me inaccuracies in Mr. Dickie's classification of the principal classes of patents, which he states are:

First—New contrivances that produce new results.

Second—New contrivances that produce old results.

Third—New combinations of old and well-known parts, whether the combination relates to the operation or to the result.

Fourth—New methods of applying a well-known device.

The classes of patentable inventions mentioned by the Revised Statutes are:

First—Arts, which term is construed to mean methods or processes.

Second—Machines.

Third—Manufactures, by which is meant articles of manufacture.

Fourth—Compositions of matter.

Fifth—Improvements thereof.

Mr. Dickie has divided the first three of these into four classes, of which the first three must fall under the second and third heads of the statute, but since almost every "contrivance," whether it be an "article of manufacture" or a "machine," must consist of and be claimed as a combination of at least two elements, which are necessarily nearly always "old and well-known parts," I for one fail to appreciate the distinctions he has made, nor do I understand the force of the clause modifying his class of combinations, viz., "whether the combination relates to the operation or to the result," unless it means that the combination must either produce a new result or produce an old result in a new way.

As to the fourth head in Mr. Dickie's classification, viz., "New Methods of applying a well-known device," I can only say that no patents are or can be obtained for such methods. It is well settled that if a device is old, no one can patent it again because he has discovered that it can be used in a new way to produce a new result. In other words, an inventor is entitled to all the uses of his invention, whether he foresaw them or not when he applied for his patent.

Mr. Dickie believes that few inventions

are worthy of patent protection, for he says at page 145, third column, "The mechanical arts have reached such a stage of development that new combinations of mechanical devices, in the sense of invention, are hardly possible."

At page 146, third column, he states his views of what should be patented, which coincide exactly with the object of the patent statutes, "I believe in rewarding everyone who, by invention or skill, succeeds in making new combinations of well-known devices to accomplish results whereby the public will be ultimately benefited."

Again at page 147, second column, he speaks of the examiners of the Patent Office as knowing "nothing of what is going on in the great industrial establishments where the *real* inventions, that result in progress, *are being made every hour of the day*, with no thought of protection from patents."

These three statements hardly seem consistent. What can the "real inventions" "made every hour of the day" in the great industrial establishments be except "new combinations of mechanical devices?" It is perhaps hardly worth while to state, what I know personally to be true, that among the examiners of the Patent Office there are a good many who do know a great deal about the practical side of the arts which they examine, who are accustomed to visit the industrial establishments from time to time, and who keep in touch as well as they can by reading the technical papers, because it is of course equally true that there are among them men of the kind described by Mr. Dickie. Everyone knows that the plan of appointing to government positions now in vogue, and still less that of former years, cannot possibly result in securing a full quota of efficient men, not to mention the impossibility of holding them at the salaries offered, yet the examiners are often better informed in a broad sense as to what is going on in any particular line of industry than those engaged in it, for the simple reason that, being further away from it, they can get a more comprehensive and impartial view. It is not quite clear how Mr. Dickie would arrange matters so that the examiners could attend to the extensive and constantly increasing work of the Patent Office, and at the same time keep track of the "real inventions" which "are being made every hour of the day in the great industrial establishments with no thought of protection from patents."

What possible test could be applied, as Mr. Dickie suggests, to distinguish between the "real inventor" and the "combination man?" How can an examiner who has hundreds of applications, with perhaps an aggregate of several thousand claims to pass upon every month, pick out the "real inventions"? Furthermore, the courts have repeatedly decided that the Office cannot consider the question of the commercial importance of an invention, the test of patentability being whether what is claimed is new and useful. It is not true that the "examiner is concerned only to find whether someone has not patented the same thing or combination of things before." Hundreds of claims are rejected every month on the ground that no invention was involved, although the exact combination claimed cannot be shown in any prior patent or publication. This is, however, a ground for rejection which is not popular with the attorneys or the applicants themselves, and they almost invariably argue that the examiner has no right to hold that a new combination does not involve invention, and that the applicant should have the benefit of the doubt, leaving the courts, should the patent become involved in litigation, to decide that question. Some examiners take that view of the case and that is one reason why so many patents are declared invalid. The courts in deciding the question of patentability, have a great deal more information than the examiner. In the first place, when an attempt is made to show that a patent is invalid, a search called a validity search is made on which experts often spend weeks or months, which results in a great number of prior patents, United States and foreign, as well as publications being put in evidence which the examiner, by reason of the extremely limited time he can spare for each case, could not find. Then the testimony of persons familiar with the prior art, and that of experts is presented to the court, which has also the benefit of opposing arguments of counsel. The examiner has not only to decide the same question as the court, without all their advantages, but also to procure the evidence himself and all perhaps in a few hours, while the number of claims he is obliged to pass upon is many times greater than those put in suit. Many patents issue with from 10 to 100 or more claims, but it is very rare that more than two or three claims are involved in any one suit.

I was sufficiently interested in Mr. Dickie's account of the "obstructing" patent on electrically operated water-tight doors to look it up, and I find that its broadest claim reads as follows:

"The combination of a door, means for operating it electrically both locally and from a point at a distance from the door, and means at the door for taking control away from the distant point."

Now, without knowing anything about the validity of this claim in view of the prior art, except from what I learn from Mr. Dickie's paper, I wish to call attention to the fact that this is not a claim covering broadly the application of electric power to the operation of a door formerly operated by hand or hydraulic power. It is, speaking from my own experience, the universal practice of the Patent Office to reject claims which cover broadly the mere substitution of one well-known form of power for another. There must be included in such a claim something as an element which was not obvious, some construction or arrangement used in the substitution or application of the power which would not suggest itself to a man skilled in the art. Of course, that criterion is, and must always be, a matter of opinion, and it may often happen that the examiner is rather more liberal in deciding what is or what is not obvious to a person skilled in the art than an engineer or other expert would be. Where there is a doubt it must be resolved in favor of the applicant, and less hardship in the aggregate results from that practice than would from a very severe ruling on the subject.

Now, the claim in question includes as a necessary element of the combination (and doubtless it was the element that "carried" the claim) "means at the door for taking control away from the distant point." In the absence of a patent or publication describing such an arrangement it would have been an unwarranted assumption on the examiner's part that no invention was involved therein. To decide that he would have to know all about what had been actually done (not patented merely) in that line before, and then to formulate his opinion of how much a skilled person should be expected to do without performing an inventive act. To obtain and digest all the evidence necessary to determine such a question with justice would occupy weeks of time if it were to be done by a commission specially appointed by Congress to investigate the subject, whereas the examiner had to decide it off-hand, so to speak. Obviously it is better, in a case like this, to resolve the doubt in favor of the applicant; then, if the patent is thought well enough of to warrant the bringing of a suit for infringement of its claims, the matter can be decided in court, with all the facilities referred to above, for arriving at the true opinion which will be in the end of the greatest benefit to the whole people. It is of course unfortunate that litigation, even when caused by the necessity of defending a charge of infringement based on an invalid patent, is so costly, but that is another story, as Kipling says.

At Berkeley, Cal., a gentleman who has been bedridden for a number of years and who suffers from the humidity of the climate as well as from the heat of the outdoor air, has had installed in an outbuilding about 150 feet from the house a ½-ton daily capacity refrigerating plant with about 300 feet of piping placed in one corner of his chamber. The compressor is operated by means of a small gas engine and is run about 22 hours per day in summer and 16 hours in winter. The plant has proved very helpful, the invalid states, in drying the air in the room and in reducing the temperature by day and at night to such a point as to check the perspiration from which otherwise he suffered. Circulation of air in the room is maintained by means of ventilators, but a fan is to be added for this purpose.—*Ice and Refrigeration.*

Making a Lot of Herring-Bone Grate-Bar Patterns.

BY J. L. GARD.

The photographs herewith are intended to tell, with the help of as few words as possible, the story of the making of a lot of grate-bar pattterns of the familiar herring-bone type. The photographs at least carry the assurance that the job was actu-

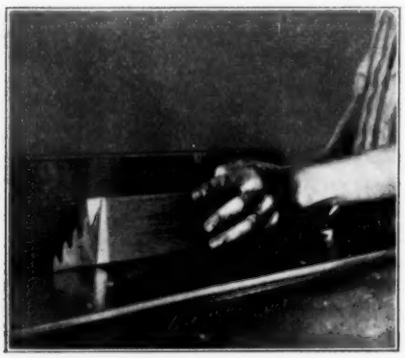


FIG. 1. SAWING THE TAPER STOCK FOR THE PATTERNS.

ally done, and they represent practice entirely and theory not at all.

Fig. 1 shows the sawing of the taper stuff for the bars on a modern pattern shop saw, the rectangular piece being tipped over, as shown, and two bars being cut from each piece. Fig. 2 shows the planing of the edges on a shoot-board to correct the angle. The board was reversed to plane the thin edge.

Fig. 3 shows the cutting off of the bars on the saw, the block they are held against being planed to suit the taper of the bar, as well as to give the correct angle at the ends. They are cut right and left by moving the block back and forth and cutting on the alternate angular faces.

In Fig. 4 the ends are trimmed for the glue joint, the same block being used that was used for a backing in cutting them.

Fig. 5 shows the bars being glued together at the apex of the angle. They are

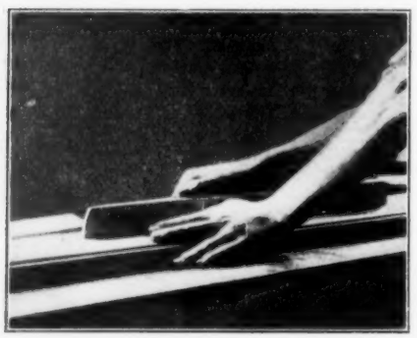


FIG. 2. CORRECTING THE ANGLE OF THE EDGE.

placed against a block planed to suit the taper of the bars. By using each of the four corners successively, the glue on the first piece sets sufficiently by the time the fourth joint is glued. The first piece is then removed from the form, and the operation is continued right around the block. After the glue was thoroughly hard, screws were put through the thick portions and nails in the thinner parts.

Fig. 6 shows the trimming of the ends on a form to the correct length and angle to fit between the main side bars of the pattern. The rectangular piece between the hand and the form serves as a stop for the length by contact with the trimmer knife *back* of the cutting edge. This was fastened to the form with screws so that it could be adjusted.

Fig. 7 shows the operation of gluing the bars in place between the side bars. They were put in place and held about a half minute, when glue was set sufficiently to hold them. After all bars were in place, screws were put through the side bars into each of them, and leather fillets were set in the acute angle corners. The place cut away lower on one of the bars was left for a rapping plate, setting the heavy center bar down instead of cutting it away. This was a special rapping plate consisting of a casting with lugs projecting down the outsides of the bar, which lugs formed the part of the pattern that makes the space between the main bars. The

FIG. 3. CUTTING-OFF THE BARS.

pattern being between these lugs, it is impossible to rap the plate loose, and also in drawing the pattern the strain comes on the screws which are through these lugs into the main side bars.

Fig. 8 shows the first bar completed, the next one without the rapping plate or end pieces on. The rapping plates for all the bars and the cross-bars ready to be put in the partially completed bars are in front.

By using forms and gages, as shown, for all this work, the boys did most of it and did it well, because they *couldn't* do it wrong. Each operation was done on all the pieces before taking up the succeeding operation on any part, the result being that we made excellent time on the job, the total length of the five bars being 20 feet.

The "Fatal Blue Heat" in Boiler Making.

Not only the foreman but every boilermaker apprentice should understand the fatal blue heat. Hundreds of plates have failed through the ignorance of the workman who was not familiar with the awful results which may at any time be brought about by a fatal blue heat. I have often seen foremen raise "Ned" with a workman because he cracked a plate when working it, though the man was ignorant as to the reason why the plate cracked. The foreman who will call a man down for putting on heaters to heat up corners and cracking them while laying them up, does so because he himself is ignorant on this subject and therefore could not ad-

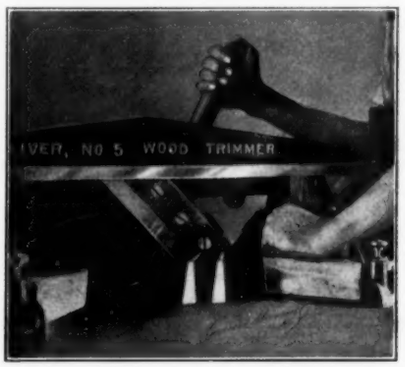


FIG. 4. TRIMMING THE ENDS.

vance any theory as to why the plate cracked. On the other hand, foremen who have made a study of the strength of materials at different temperatures would not think of calling a man down for breaking a corner, but upon inspection would see that the workman was not familiar with the results of striking iron or steel while it still contained the fatal blue heat, and would show him where he was at fault and warn him against the danger of striking steel while it showed a blue color.

Every boilermaker and apprentice who is not posted on the fatal blue heat should at once become familiar with this subject through an actual test, which can be made in the following manner:

Take a piece of steel about 2 inches wide and about 24 or 30 inches long, any thickness from, say, $\frac{1}{4}$ to $\frac{3}{8}$ inch. Grind the surface on the emery wheel or grind-

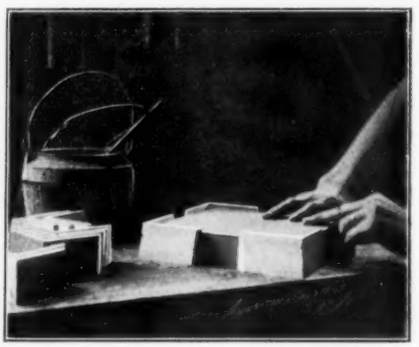


FIG. 5. GLUING THE PIECES TO FORM THE CENTRAL ANGLES.

stone until it becomes bright for a distance of about 10 or 12 inches on one end, so that you can observe the color when it makes its appearance. Then take it to the blacksmith or flange fire and hold it on top of a clean fire, thus preventing it from becoming smoked up so badly that you

cannot see the color. Now move the piece slowly back and forth over the fire and watch it closely until the blue color appears, which will be about the same as is used for tempering a flat chisel for boiler shop use. Then take the piece to the anvil and bend it over double without breaking it if you can. You will find that

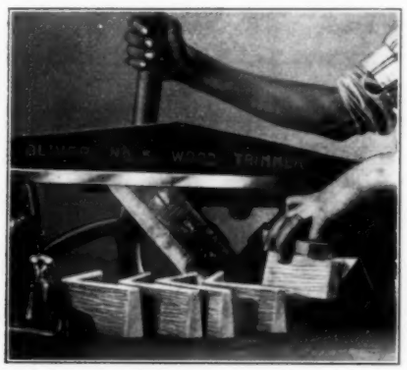


FIG. 6. FINAL TRIMMING OF THE BEVELED ENDS.

it will break every time. Take the other end of the same piece, which is perfectly cold, and you can bend it over double without breaking. (The higher the tensile strength the quicker it will break. Soft firebox steel will not break so readily.) This experiment will prove to your satisfaction why many corners have been cracked by heating them just hot enough to produce a blue heat, as the steel will stand far more abuse perfectly cold than it will at a fatal blue heat. If you are working up steel and you see the blue color coming into the steel, *stop* at once and apply more heat, or you may wish you had taken the advice herein given. Heaters [chunks of hot iron] should never be used in any boiler shop, as at a very small cost a little crude oil or gasoline heater can be made, and in less than five

FIG. 7. GLUING THE BARS IN PLACE.

minutes very heavy material can be made white hot and worked up without any danger of cracking the plates.

Nearly every boilermaker who has followed our advice and made the necessary experiment to familiarize himself with the fatal blue heat will insist on having some sort of a heater in the shop for doing his work properly, or he will have sense enough to tell the proprietor that he will not be responsible for the cracking of plates which are heated by placing chunks of red-hot iron on the place to be worked up. This method never heats a plate hot enough to insure working it without danger of cracking, but by using crude oil or gasoline you will never have a break if you stop pounding in time and apply the heat again. It requires but a few minutes to make it white hot again and all danger is thereby avoided.—*Motive Power.*

What Machinery Men Have Done for Brickmakers.

The following is from an address of considerable length by J. H. Chambers, of Chambers Brothers Company, the extensive makers of brick machinery, Philadelphia and Chicago, delivered at the Cincinnati convention of the National Brick Manufacturers' Association:

The history of the mechanic arts associated with any great industry is so closely interwoven with its growth that it seems well nigh impossible to separate the two. Any attempt to enumerate conspicuous steps in the growth of modern brickmaking is but to name one machine, or inventor, after another, or the application of one mechanical principle for another by some enthusiast more venturesome or more courageous than his neighbor. The brickmaker of to-day owes much of his comparative ease to the ingenuity of the inventor who delights to deal with one new problem after another, and his coworker, the machine builder, who rests not until the device is proven either a success or a failure, and its purpose relegated from the things that might be to the thing that is. For in spite of all failures, in spite of all error, the ignorance of the past, the hide-bound prejudice of generation upon generation, yield in time through the light of greater intelligence, or through the necessity of commercial competition, to that band of enthusiastic, optimistic mechanics always in advance and constantly seeking to lighten the burden of drudgery inseparable from the earlier brickmakers' task.

If we would appreciate the extent to which some of these inventions influence present-day methods, let us in imagination dispense with them. Can we see Butterworth with pick and shovel removing his 14 feet of sand and gravel from over his great deposit of shale, or Purington making half a million brick daily at one location with the aid of hand pick and shovel to dig and load his clay? Does not the one, recognizing that the sand was a water deposit of past ages, call to his assistance the hydraulic engineer and through his intelligent application of natural laws remove by water the unwonted covering; and the other, observing that the railroad engineer uses a steam shovel to make a passage through the face of the earth, argue that the same bundle of mechanisms is what he needs to dig holes for the resultant raw material?

You may say that these men are brickmakers, but in a broader sense they are

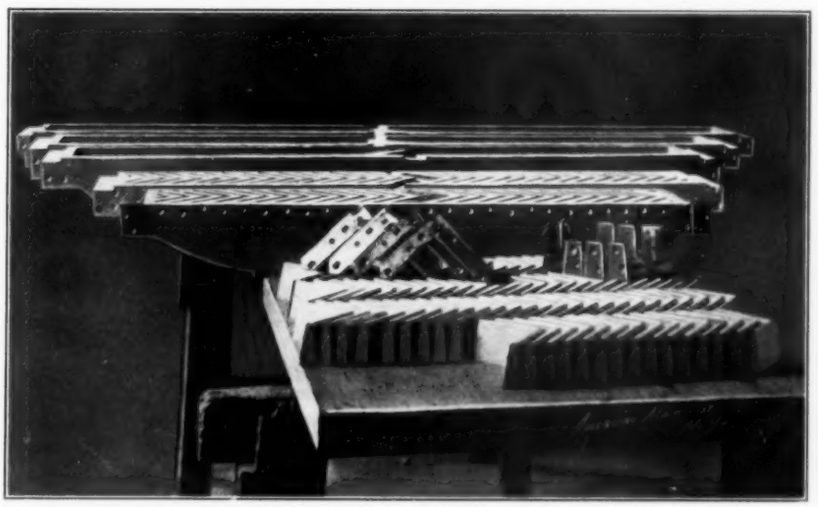


FIG. 8. PATTERNS AND PARTS IN VARIOUS STAGES.

also mechanics who have accomplished their tasks through the aid of machinery men. I know not who invented the tempering wheel and the circular ring pit, but his name deserves a crown at your hands as achieving through the combination of simple mechanical means and natural law the result that is not surpassed, and rarely equalled, by any of the more complex later day appliances. His process of tempering, if we may so term it, provides not only for the grinding and mixing that we all recognize as necessary, but also takes advantage of time as an element in producing the desired result. There yet remains the inventor who can harness time, with its gentle, mellowing influence in the reduction of our raw material, as a component part of a machine which will also meet the hurry of twentieth century brickmaking. When he comes then may we look for the perfect brick and the perfect brick machine.

Present-day brickmaking is of necessity

mechanical brickmaking, and the successful present-day brickmaker is necessarily a machine brickmaker. Hand methods cannot produce all of the various forms of brick and clay shapes used to-day, nor could the commercial demands of the business be met without the aid of the machinery man and his product.

German Experience With the Eight-Hour Day.

TRANSLATED BY HENRY HESS.

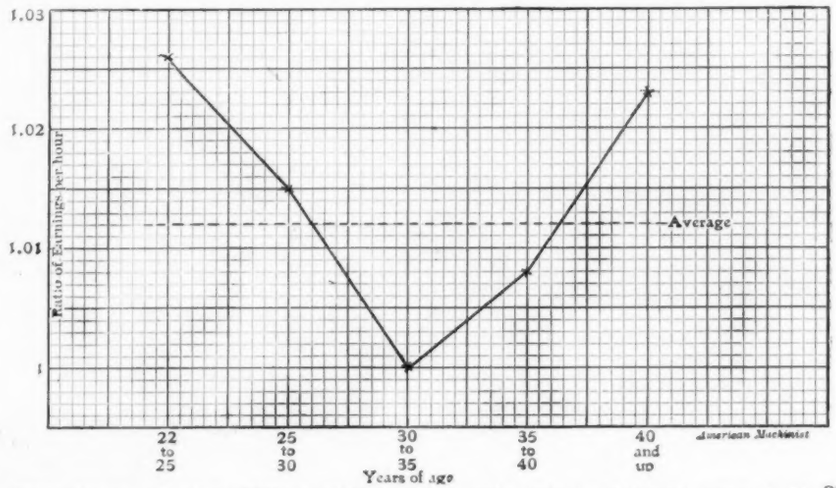
In Germany, as here, there is a well-developed movement among workingmen for the introduction of the eight-hour day, meaning by that a total of eight hours devoted to work out of each twenty-four, not a total of $6 \times 8 = 48$ hours per week with a half or whole Saturday holiday.

In urging experimental adoption on me and in support of the contention that the granting of the shortened day would result in at least no decrease in the daily production per man, the representative of the workmen's union referred me to the testimony of an employer, Prof. Abbé, head of the Zeiss Optical Works, of Jena. As Prof. Abbé gives figures based on careful comparisons of actual results, his experience is a valuable contribution to this much vexed question. The following translation and slight abridgment gives the salient facts of a report made by Prof. Abbé to the twelfth annual meeting of the German Society of Mechanics and Optics (an employers' association) August 17, 1901, on the advisability of the introduction of a nine-hour day. The advisability of guaranteeing a day rate for piece workers was also under discussion.

"For thirty-five years now I have been the manager of a works that from modest beginnings has grown to considerable size. Favorable experience was had in England with the adoption of an eight-hour day. It has been objected that English results are valueless for Germany, owing to differences in the character of the workingmen. In Jena we have tested the proposition: What is the action of German workman when asked, "Who believes himself capable of doing as much in eight hours as in nine?" After an almost unanimously favorable vote we introduced the eight-hour day from April 1, 1900, at first only for a year's trial. [Prof. Abbé has in operation an arrangement giving the men a certain voice in the internal policy of the concern. The time had previously been gradually reduced from eleven to nine hours daily.—H. H.] The results have been so surprisingly satisfactory that we shall certainly make no change. The conditions were favorable to a fair comparison with the preceding year, in which the commercial situation was also quite similar. Table I gives the results for 233 piece workers. The total piece-work hours was reduced from 559,169 to 509,559, accompanied by a wages increase from 345,889 marks ($82,300) to 366,484 marks ($87,000), a day's pay increase from 5.57 marks ($1.32) to 5.75 marks ($1.37), and an hourly earnings increase from 61.9 pfennig (14.7 cents) to 71.9 pfennig (17.1 cents). The return in work should have risen correspondingly in ratio 100—112.5, but the final result shows this figure to have been materially bettered. I must mention that there were but few alterations in piece prices. The piece worker's output rose in ratio 100—116.2, so that the result of the time reduction was a slight increase in equivalent output.

"It might be objected that such results are not possible for day workers. With us about 40 per cent. of all work is day work. That the day workers have maintained the pace set by the piece workers is proven by the fact that no necessity to increase their number has developed. But the intensity of work has been augmented, as is shown by the increase in the consumption of electric current. The greater number of our machines, such as lathes, milling machines, grinding machines, etc., are capable of an increased output at the will of the operator. The average daily useful power consumption (obtained by subtracting the ascertained line-shaft friction from the total load) was 23.2 kilowatts for the last four weeks of the nine-hour days, and 26 kilowatts for the first four weeks of the eight-hour days, a rise in ratio 100—112 [very much the same as in equivalent productiveness and practically that of the actual productiveness.—H. H.]. In the first three days the rise was 100—127, falling to 100—119 for the entire first week. The men evidently grew tired under the work entailed, since in the second week the ratio dropped to 100—105; it then rose to make an average of 112 for the entire four weeks. Unfortunately it was not possible to continue these records longer. These determinations go to prove that the increased production is not dependent upon good will but is unconscious. From the statements of many of my men I have gathered that they exerted themselves to the utmost in the first few days, but after that kept up their work in their accustomed manner; a later inquiry resulted in a declaration that their work did not tire them more than formerly in nine hours. It is clear that this adaptation of habit was automatic. The workmen thought that the firm would have a loss to record at the close of the year in payment of the costs of the experiment, an opinion that was happily refuted by the outcome.

"A Charlottenburg concern that had introduced the eight-hour day was compelled by stress of orders to fall back on nine hours. After two weeks it was found that the output fell to that normal to eight hours. It is legitimate to conclude that if good will cannot bring about an in-



RELATION OF AGE TO EARNING CAPACITY UNDER PIECE WORK CHANGING FROM 9 TO 8 HOURS DAILY.

AGE.	Number of Men.	Average Age, years.*	Average Service, years.†	Average Piece Earnings, cents per hour		Earnings Ratio.
				9 hrs.	8 hrs.	
22 – 25 years	34	23.5	5.5	13.2	15.6	100 : 117.9
25 – 30 years	69	27.3	7.9	14.9	17.3	100 : 116.7
30 – 35 years	69	32.2	10.1	15 6	17.8	100 : 114 9
35 – 40 years	40	37.7	12.7	14 5	16.8	100 : 115.8
Over 40 years	21	45.3	15.3	15 1	17.8	100 : 117 4
Totals and averages	233	31.6	9.6	14 8	17.2	100 : 116.2

* Greatest age 53, least 22 years. † Longest service 33, least 4 years.

TABLE I. ACCORDING TO AGE AND SERVICE.

"Service" means years in the employ of the firm after the 18th year of age.

creased output in an increased working time it is also incapable of reducing the output during a shortened work period. This may sound rather curious, but is really very simple: The reduction of the working time is to the human being the equivalent of the reduction of the idle time to a machine. It means only a needless tiring. It would be exactly the same thing were the employer to say to his workman. 'When you are through with your work you are to remain with your machine another hour or two.' [In many of our foundries it is usual to allow the molders to quit after pouring off irrespective of the number of hours worked.—H. H.] This extra time is a needless waste of force. In order to give time for an actual recuperation we have increased the noon recess by one hour. [It would seem that this is a vital factor in bringing about the favorable result; it does not fall in with the wishes of the majority of our workmen agitating for the eight-hour day, giving them an hour earlier quitting time or, as many advocate, a longer or even complete holiday on Saturday. It should commend itself also to those extremists who think that the longer free time gives the men only that more opportunity for getting into mischief. This Jena experience is in line with the favorable results had in schools by giving opportunities for recuperation between lessons rather than have the latter follow in one unbroken series.—H. H.] It is not equitable to demand that a man work ten hours when he can accomplish the same results in nine, and he is right when he asks, 'Why does the employer make a point of keeping me longer in his workrooms than nine hours if I do not earn more for him?'

"It is my opinion that the results given remove all basis for opposition to the considered introduction of the nine-hour day. I should not advise an immediate change from ten to eight hours, but under present conditions it is to the interest of all to work not longer than nine hours. I wish also to mention that the reduction from ten to eight hours has decreased our lighting time to 116 hours annually, a reduction of 400 hours in time and 40 kilowatts in current. Add to this the savings in heating and we have a net benefit of 16,000 to 17,000 marks ($3,800 to $4,000) annually. For a nine-hour day the saving would be about one-half this. [The latter statement is undoubtedly an error; the second hour in changing from ten to eight is productive of more than a proportionate saving in lighting.—H. H.]

"Several years ago we agreed to guarantee day pay to our piece workers, as it was contended that piece prices were determined by the faster men, so that the less able frequently could not earn day pay. The workman is entitled to this since it is a fact that good, diligent men accomplish more under piece work because they exert themselves more; but it does not imply that the men soldier on day pay, as experience has shown that piece work brings the mental activities more into play. Thirty years ago my then eight or ten men were seemingly at the limit of their ability as to output. A considerable order prompted recourse to piece work. The first month brought so small an increase that I thought not to accomplish anything by the change, but month after month brought improvement. Half a year later pay had risen 30 per cent., a year later 70 per cent., and after two years it was doubled without detriment to the quality of the work. I do not consider the result due to greater diligence, but to more intelligent working —to making each move tell. Our rates are so set that men accustomed to our work can earn 25 to 30 per cent. more than day pay. We have new men do their first one or two jobs by the day rather than have recourse to the guarantee of day pay should they not reach that in piece work."

	Number of Men.	Average Age, years.	Average Service, years.	Average Piece Earnings, cents per hour		Earnings Ratio.
				9 hrs.	8 hrs.	
Optical Division.						
1. Lens setters (fine hand work)	21	31.1	12.7	17.3	20.2	100 : 116.6
2. Microscope grinders (fine hand w'k)	20	33.2	13.8	18.9	20.7	100 : 109.1
3. Other grinders and centerers (hand-work only)	59	26.1	7.5	13.4	16.8	100 : 116 7
4. Machine grinders (mach. work only)	19	32.1	5.8	12.5	14.8	100 : 118.8
Mechanicians and Others.						
5. Adjusting shop (hand work only)	22	31.7	8.2	15 6	18.3	100 : 117.1
6. Erecting shop (chiefly hand work)	20	36.9	11.6	15.9	18 7	100 : 117.9
7. Turning and milling (mach. w'k only)	23	35.2	11.1	13.8	17.2	100 : 118.1
8. Polishers and lacquerers (hand work only)	17	34.7	11.2	12.8	15.1	100 : 117.7
9. Engravers (hand work only)	5	27.2	6 8	13.4	16.0	100 : 119.3
10. Molders (handwork only)	6	36.2	9.7	13.5	15.5	100 : 114 9
11. Carpenters (hand and mach. work)	15	35.2	10.5	12.5	15.0	100 : 120.3
12 Bookbinders — casemakers (chiefly hand work	6	30.4	6.4	13.3	15.0	100 : 112.7
Totals and averages	233	31.6	9 6	14.8	17.2	100 : 116.2

TABLE 2. ACCORDING TO CHARACTER OF WORK.

Translator's Note on Effect of Age on Earning Capacity.—As in Table I, Prof. Abbé gives the result of his experiment in detail for various ages of his men, it is very natural to inquire what influence age has on earning power. This is graphically shown by the diagram in which the "earning ratios" of the table are plotted in their relative ratio to the lowest record, that at age 30 to 35, as unity. As the line is highest for the lowest age, it is apparently evident that the younger men are better able to stand the higher pressure and that this pressure tells with advancing years in the curtailment of their ability to keep up the pace. From 35 years onward the line again takes an upward trend. In the absence of more detailed data it is suggested that this may be due to older and more staid men having less outside distractions and so leaving them free to concentrate more mental effort on their work to aid their increasing skill to counteract their lesser ability for muscular exertion; in shop vernacular it is mule power with the young men and brains mixed with their elbow grease with older men that gives the advantage over those of middle age.

The Field of the Mechanical Engineer.

The following is taken from a paper by Carl C. Thomas in the *California Journal of Technology:*

It is intended to answer, in a very general way, the questions—what is the field of activity of the mechanical engineer, and what knowledge does the student of mechanical engineering need to acquire as an equipment for his professional work?

The very general lack of comprehension of the duties of the mechanical engineer arises from the fundamental character of his work, which lies at the foundation of the majority of the world's industries, so far as they are carried on by mechanical processes. It is the duty of the mechanical engineer to devise and produce ways and means for providing motive power, and design the equipment for carrying on engineering industry. It is his duty to utilize, in the most economical manner possible, the energy found in Nature, and to adapt it to useful ends. He designs and directs the construction of steam engines and boilers, steam turbines, gas engines, water wheels, and the vast array of pumps, condensers, air compressors, transmission gear of all kinds, and everything necessary to transform energy into useful forms. The mechanical engineer delivers power to the electrical engineer for the operation of electric generators.

To accomplish these results requires practical experience, guided by a knowledge of physics, mechanics, and, in general, of the laws governing energy as it occurs in Nature. The production of motive power from the natural sources of energy is accomplished by what are known

as the prime movers, among which are the steam engine, the gas engine and the water wheel. The principle of each of these prime movers is embodied in various forms, each devised to fulfill certain requirements depending upon the use to which it is to be put, and the availability of the natural form of energy it aims to utilize. Thus, the steam engine is brought out in the single cylinder, simple, non-condensing form, wasteful of fuel but easy to care for. Such an engine may be used to advantage where fuel is plenty and labor high. Again, the compound, triple and quadruple expansion types of steam engine, with condensers and air pumps, are found advisable in other localities in order to use as little fuel as possible, and thus cheapen power production. Mechanical engineers are continually striving to improve upon existing machinery. The steam turbine has already attained results in many ways superior to the finest steam engines of the reciprocating types mentioned above, though in some respects it is less convenient thus far. The internal combustion engine, burning the fuel in the cylinder itself, thus doing away with steam boilers and condensers, is now in the front rank of prime movers. In fact, in point of efficiency it is far in advance of the other heat engines, developing motive power at very much lower cost for fuel and attendance, but still less convenient of application to many uses than the steam engine.

In localities where water power is available, the water wheel is by far the most economical means of obtaining power in convenient form, and this may be distributed over large territories by the present systems of long-distance transmission. It is in the design, construction and application of prime-movers, and transmission machinery, that the term of mechanical engineer finds its especial significance.

In addition, the designing of machinery of application is properly the work of the mechanical engineer, but it is at this point that specialization commences. Civil engineering and electrical engineering are distinct professions, and each has its specialists working along particular lines of each profession. In the same way mechanical engineering is subdivided, and there are industrial engineers, heating and ventilating engineers, those engaged in the design of hydraulic machinery, and still others designing and building air compressing machinery. The list is too long to attempt to more than indicate its diversity in a general way.

The following will further indicate the character of the mechanical engineer's work. Where electric power is to be developed, prime movers are required for running the electric generators. The types at present in use are the following: Reciprocating steam engines with their boilers, condensers and pumps; steam turbines, with boilers, condensers and pumps; internal combustion engines, with their supply of gaseous or liquid fuel; water wheels, with their supply of falling water. The storage battery is not at present in commercial competition with these motors.

Further, where building or manufacturing material is to be produced, such as iron, steel, copper and its alloys, cements and artificial stone; where coal and ore are to be transported, loaded and unloaded from ships or cars; where steam locomotives, railroad rails and cars are to be produced; where buildings are to be heated and ventilated; in all these and many other fields of industry mechanical engineers are required to design tools and appliances for carrying out the work of production, as well as to design and superintend the construction of the finished product.

While the men in executive charge of these industries are all mechanical engineers in the broad use of the term, no man of experience and with just appreciation would claim to be competent to take charge in all or even in more than one or two of the branches named.

The demands made upon engineers of all classes are becoming constantly greater, and the different branches are overlapping, each specialist playing into the hands of other specialists whose work he must in a general way understand.

The education and training of an engineer should be such as to enable him to analyze a problem in detail, logically, and to apply fundamental principles to its solution. In order to make a comprehensive analysis the mind must grasp the problem in all its details, and to do this requires practical experience in actual work along the line of the question in hand. Nothing can take the place of concrete knowledge of the circumstances likely to occur during the progress of the work in question, and such knowledge of detail cannot be taught in books.

A railway company in Illinois has a generator centrally located from which it can lead wires to a portable motor which is temporarily placed in farmyards along the line to drive threshing machines, wood cutters, etc., as may be required.

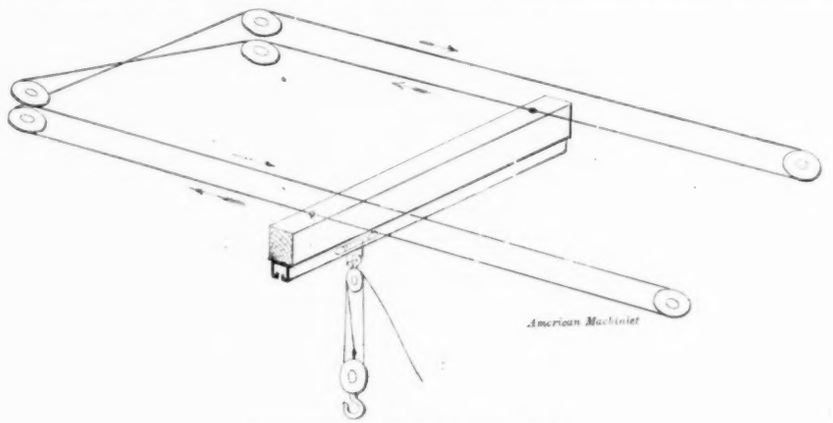
A Cheap Traveling Crane.

BY M. W. SHERWOOD.

The accompanying sketch shows a crane which we installed recently in a building which we fitted up for the manufacture of concrete building blocks. The blocks weigh about 200 pounds each, and some convenient arrangement was desired for taking the blocks from the machine and placing them on the floor, where they were allowed to remain until the cement had thoroughly set, from which they were removed to a shed.

A traveling crane seemed to be most suitable for utilizing the entire floor space to the best advantage, but it was essential that it should be quite inexpensive, as the appropriation for the work was limited and extravagances were not to be tolerated. Overhead tracks and trolleys were proposed, but the light crane to be described proved so entirely satisfactory that I present it to the readers of the AMERICAN MACHINIST, believing that it will be found useful in many instances.

The crane consists of a bridge made by spiking a few planks together, or a single stick of timber might be substituted. The ends are hung from trolleys running in track attached to the ceiling, or to timbers on posts. Another strip of the track is attached to the bridge and carries a trolley on which is hung the chain hoist or tackle blocks used for lifting the weight to be transported.



SQUARING DEVICE FOR LIGHT CRANE.

The essential feature of the rig, however, without which the crane would be useless, is the arrangement for making both ends of the crane always move at the same rate, so as to keep the crane square. In regular traveling cranes this is accomplished by having two of the wheels at opposite ends of the bridge connected together by shafting, which compels them to rotate in unison. This method could not be applied conveniently to a crane hung by trolleys like this one, and would, moreover, involve considerable expense.

In this crane the same end is attained by an arrangement of cord and pulleys similar to that used on drawing boards with parallel ruling attachments. I do not know of its having been applied to a

crane before, but it serves the purpose admirably. The way it works is shown in the sketch.

The only material required for such a crane, besides the lumber and chain hoist, consists of the three trolleys with a sufficient amount of track, six pulleys and a light flexible rope for the parallel device. It is desirable that as flexible a cord as possible be used, as otherwise it will not bend freely around the pulleys, and this may interfere a little with the free movment of the crane.

Suitable track and trolleys are made by the Wilcox Manufacturing Company and the Coburn Trolley Track Manufacturing Company. For the pulleys of the parallel device we procured ball-bearing pulleys from the Gardner-Champlin Company. By some the ball bearings would be considered unnecessary, but they are quite inexpensive and tend toward greater ease of operation.

With a crane equipped in this way, the load can be carried to any point on the floor, it being only necessary to push the load in the desired direction. The bridge always travels parallel with itself, regardless of whether the effort is applied at the center or at either end, and there is no tendency to stick or bind. Of course everything should be well oiled at first.

The fact that the crane can be suspended from a ceiling without requiring the usual posts and ways will enable it to be installed where a regular crane would be out of the question.

Getting a Fine Surface on Brass Castings.

BY C. VICKERS.

Every jobbing brass foundry will once in a while get orders for castings which are required to be smoother than ordinary work. A very frequent job, and one that will serve as an illustration, is a die the surface of which is sunken and deeply carved with some ornamental design. Such patterns are often made in plaster of Paris, and the bronze castings therefrom are used for imprinting decorative designs on the backs of chairs and other wood surfaces, in imitation of carving. They are generally cast in hard bronze, and should the castings be rough the price of the finished article is greatly enhanced because of the costly tool work. It is requisite, therefore, that the working surfaces of such castings be as fine and smooth as possible, and to secure this it is necessary to "print back" such molds.

The method here outlined I have used with success. Although it is not generally known, in the sense of being understood by every foundryman, yet it is not new.

Before commencing to mold, if the castings are heavy, it will be advisable to mix up a facing sand. For this take 3 parts of new and 1 of old molding sand, and to every 15 parts add 1 of flour; mix well, wet with water until a little more damp than ordinary "heap" sand, then screen. Sift this facing on to the patterns through a sieve not coarser than a No. 8, filling up the flash with ordinary sand, and *ram soft*.

On work where there is no impression in the cope, but simply a flat back, it is not necessary to "print" the cope; so it may be rammed as is usual with other work. The cope is then lifted off and the pattern is gently rapped to loosen it, after which the cope is replaced and the mold is rolled over. The nowel, being now uppermost, is carefully lifted off the patterns; this operation is assisted by a very gentle rapping upon the sides of the molding tub. The patterns, resting upon the cope, must on no account be disturbed, because if they are moved it will be difficult to get them back to place, and an imperfect reprint will be produced.

The patterns must be scrutinized to see if they have torn the sand anywhere. If so, spray the mold with molasses water and roughly build up the broken places, making them a little "full," and firm enough to hang when the nowel is inverted; now spray again with the molasses water, this time thoroughly, and dust on the printing sand. Blow off with the bellows to drive the dust on to any vertical surfaces of the mold; dust a second time with printing sand, but gently, giving a uniform deposit. Blow out any accumulations of dust from recesses of the mold where it is apt to gather in unnecessary quantity. Now wait a moment until the dust becomes damp, then carefully and thoroughly dust lycopodium powder over both the impression and the joint of the mold. *Never omit this*, or there will be a failure. The nowel is again closed on to the patterns, and the bottom board is removed. The nowel must now be re-rammed, using only the butt end of the rammer. The mold being rammed soft in the first place, the re-ramming brings it to the proper density. The bottom board is again bedded in place, and the nowel lifted off, leaving the patterns on the cope as before. Examine the impression closely to make sure there is no break anywhere. If there should be, the broken portions must be built up with sand, dusted with a little lycopodium, the mold closed on to the patterns and gently re-rammed over the defective spot. Generally a printed mold, if properly made, will give a perfect "lift," as the surface is much stronger than that of an unprinted one.

A perfect impression being obtained, the patterns are removed, and the mold is finished in the usual manner, with the exception that it is better not to flour it, unless the flour is dusted through a very fine bag, and sparingly. The mold must be surface dried before casting.

A more rapid method of "printing back," especially adapted for small metal patterns, is as follows. In this case the necessity for skin drying or baking is avoided, and the pattern which needs special treatment may be run in the same mold with other patterns that do not need the printing. When the oddside is made, the patterns that need only ordinary treatment are placed in such positions as are usual with ordinary work, but the one that must be printed is arranged with its surface lower; that is, its parting line is sunk into the match about $\frac{3}{8}$ inch, so that when the match is lifted off the inverted nowel, this particular pattern will be raised $\frac{3}{8}$ inch above the joint of the flask. Before any trimming is done to the joint this pattern is removed and its impression is dusted with the facing and then with lycopodium, and the pattern is replaced and driven down into the sand until its parting line coincides with the joint of flask. This prints it back perfectly. The joint is now trimmed and the cope is rammed.

The cope also may be printed if necessary. All that need be done is to dust on facing first, then lycopodium, close down and re-ram. The mold may then be finished in the usual manner. This method of printing, while it is only applicable to patterns that may be rapped down, is very useful, as it admits of molding fine and ordinary castings, in the same flask, with little extra work. It must be observed that in this case water is sprayed on sparingly if at all, and skin drying is not necessary.

There are other methods of making fine brass castings than the one here outlined, and manufacturers who make a specialty of artistic castings are naturally equipped for their chosen class of work, and have their own methods of making it, born of experience and experiment. For the specialist, therefore, this article is not intended so much as for the ordinary jobbing brass foundry, where French sand is not known even by name, where all the sand piles are the same, neither very fine nor very coarse; where they make light, thin castings one day and heavy machinery castings the next.

To properly complete this article a description of the material used for printing back, as well as of methods of skin drying is necessary. I have experimented largely with different materials suitable for printing back, one of the first things tried being the molding sand dust from the shop floor; I then tried all new sand dried. The new sand is superior to the dust, and it is improved by the addition of flour. Plumbago, charcoal, and soapstone were all tried and found wanting. Finally, new sand was put into an old crucible, burned in the furnace and afterwards pounded fine in a mortar; about one part of flour to eight of sand is added, and as much of this mixture as can be handled conveniently is put into a bag of close texture from which it is dusted on to the mold as required.

A field for experiment will be found in printing sands, the object being to obtain a mixture that will produce on the casting

a bright, smooth surface, and will not "blow," "cut" or "scab."

It is not always necessary to surface-dry a printed mold, provided the printing sand will cling to the mold and not "wash" or "peel," without being held down by molasses water. The use of molasses water of course necessitates drying, as it introduces too much moisture.

In all cases where there are delicate

FIG. 10. AUGUSTA IRON WORKS 57 YEARS AGO.

sand projections in a mold common sense will suggest that it is safest to dry, and the molasses water may then be used freely as it strengthens the impression.

In drying flat work, such as name plates, etc., a blow torch is serviceable, but on deeply cut work the torch will burn off thin ridges or projections of sand and leave the deep cavities green enough to blow. For such work a charcoal fire is the best, and the easiest to apply. Take a piece of the bottom of an old sieve, prop it horizontally a couple of inches from the floor, to permit a draft of air to pass through it when it becomes the grate for the charcoal fire. Over the sieve put any iron ring that will hold a couple of handfuls of charcoal. A piece of two- or three-inch stovepipe is as good as anything. Place a little charcoal inside the ring, then a red-hot coke and more charcoal; a good hot fire is the result.

The oven is made by placing two or three flasks (the same size as used for the mold) over the fire. The mold is dried a half at a time. The cope or nowel, being closed, impression down, over the top flask of the oven, the fire is thus underneath, so the mold gets the benefit of all the heat, and is quickly and thoroughly surface dried.

Anticipating inquiries as to lycopodium, I may as well state that it is an impalpable yellow powder. Its value as a parting medium lies in the fact that it will not mix with water, and while it is very inflammable it does not boil, like rosin, under heat, and roughen the casting; therefore it is invaluable for printing back, preventing the thin layer of facing from sticking to the pattern; for this purpose it has no equal. Most of the lycopodium of commerce comes from Russia, and is, I believe, merely the pollen of the club-moss.

Hunting Old Furnaces in the Ramapo Mountains—II.

BY E. P. BUFFET.

In the previous sketch under the above caption I described and illustrated some of the furnaces of the Sterling Iron Works. Let us now take up their story in chronological sequence.

In the Boonton article, published two years ago, it has been told how, in 1764, "Baron" Peter Hasenclever's "London Company" bought out the "Ringwood Company" of the Ogdens and how John Jacob Faesch and later Robert Erskine were brought over as managers for its properties, which at one time or another included forges and furnaces at Ringwood, Long Pond (now Greenwood Lake) and Charlottenburg.

Its interests also embraced an iron plant at Haverstraw, N. Y., and other industrial undertakings. At least one historian has followed a report that before 1750, Hasenclever had set a company of German miners prospecting and operating in the present counties of Orange, Putnam, etc., N. Y. This is almost certainly a mistake, but it is true that there was some iron working carried on in New York State before the middle of the eighteenth century.

It was in 1750 that the discovery of a rich superficial deposit of magnetic ore at the south end of the Sterling mountain led to the erection, the following year, by Ward & Colton, of a furnace which is described as "near the outlet of Sterling lake." There is some reason to doubt whether the present Sterling lake existed at that time or was of subsequent artificial construction. A forge was built in the vicinity, in 1752, by Abel Noble, of Bucks county, Pa. The name Sterling is universally supposed to have been derived from the owner of the land, Wm. Alexander, titular Lord Sterling, later a general in the Continental army. Peter Townsend came into partial possession as early as 1773. The disposal of the output of the establishment appears to have been at one time largely in the hands of William Hawkhurst, who, in 1761, unsuccessfully petitioned the Provincial Council for a thirty years' monopoly of making anchors and anvils in the colony. In 1765 he advertised that he had lately erected "a finery and great hammer for refining Sterling pig iron into bars." His customers, on application to him in New York, could be supplied with a great variety of iron and castings, as "flat, square and bar iron; cart, waggon, chair and sleigh tire; mill spindles, wrines and iron axle trees, cast mill rounds and gudgeons, fullers' plates, forge plates, forge hammers, and anvils, pots, kettles, potash kettles, and plates or hearths for pearlash furnaces, sugar and still-house grates, fifty-sixes and smaller weights, sash weights, etc." He could also furnish anchors and pig iron and sundry sorts of edge tools, viz., "short bitted pole-axes, and Virginia and Carolina made hoes and bills," etc. There was an announcement in a New York paper (spring of '76?) that "The steel forge with six fires, lately advertised . . . to be built by Messrs. Noble and Townsend at Stirling is agreed for and in great forwardness, will be compleated in June next, when they hope to be able to supply the public with steel in a more plentiful manner than heretofore, they yet having had only two fires employed in making it; the said steel may be had by applying to William Hawxhurst in New York who warrants the same to be good or to return the money. Said Hawxhurst has also to sell Stirling refined iron, Jersey refined do. from several different works in the Jersies; Stirling and Jersey refined sharemould; likewise Bloomery iron, a parcel of Swedes iron, Stirling pig metal, pot-ash kettles, anchors and grindstones as usual. N. B. Great encouragement will be given to workmen who understand manufacturing pig metal into steel, in the German way."

As may be judged from the foregoing, a leading product of the Sterling works was anchors. It is claimed that the first anchor forged in the territory of the present New York State was made there in 1753. An earlier anchor shop had been established in Rhode Island. The anchors of the "Constitution" and other early warships were Sterling products. Peter Townsend made steel as long ago as 1776 and was practically the pioneer of that art

FIG. 11. AUGUSTA IRON WORKS TO-DAY.

in the province. He is said to have made it at first from pig and afterwards from bar iron, in the "German manner," which manner was the process generally employed in the early American attempts at steel making. His son, Peter Townsend, Jr., is also regarded as marking an epoch of enterprise when, in 1810, he produced blister steel from ore of the Long mine on the Sterling estate, which had been

discovered in 1761. This steel was thought to be "of as good a quality for the manufacture of edged tools as that made from Dannemora iron." James M. Swank,* however, seems to be of opinion that blister steel had been made by Peter, Sr., in 1776, reasoning, perhaps from the use of bar iron. The "German manner" and the "blister steel" or cementation process are about the only two methods recorded as used in America previous to 1812. It is further stated by one historian that in 1816, Peter, Jr., cast for the government cannon of 6 to 32 pounds which were the first made in the State. The last clause seems intrinsically improbable.

A second Sterling furnace was built in 1777. Capt. Solomon Townsend, cousin and son-in-law of Peter, Sr., purchased of the latter, about 1783, a great mountain estate and founded on the Ramapo river the Augusta iron works. He lived in New York, where he kept a bar-iron store, and he had another forge at Riverhead, L. I. He is said to have lost $70,000 by the embargo of 1808. Peter and William Townsend, who evidently were sons of Peter, Sr., built still another furnace at Southfield (or Monroe, as the place was at one time called) in 1805 or 1806. About a mile away were established the "Monroe Works" by J. Blackwell and H. W. McFarlen in 1808. They made hoop and sheet iron, nails, shovels, spades, hoes, etc. Messrs. McCoun and Daniel and William Jackson built a plant on the outlet of Duck Cedar pond in the war of 1812 to manufacture nails and sawmill saws. The oldest of the existing stacks (Figs. 3 and 4) is traditionally reported as having been blown out about 1810.

About the middle of the last century the holdings of the Townsends, including the Sterling and Southfield works, but evidently not the land that had belonged to Solomon Townsend, comprised some 20,000 acres, which supplied iron and charcoal for the furnaces. The construction of the new furnace at the little Sterling lake, which was shown in Fig. 6, is orally attributed to 1840 or 1850, but I have not a certain record of its date. It was operated up to about 1890. The amount of ore taken from the Sterling mine (exclusive of the other mines on the Sterling estate?) by 1842 is estimated at 140,000 tons. The ore from this region has enjoyed high favor for the toughness of its metal and it is rumored that some of it still goes into Bethlehem armor plate.

I do not profess to identify precisely the ruins and sites of all the plants described. The furnace shown in Figs. 3 and 4 is more likely that of 1777 than that of 1751. I understand that a furnace traditionally stood at a place called Black Meadow between the big and little Sterling lakes, and this may have been the oldest of all. The furnace at Southfields (Fig. 1) I should at the present stage of inquiry take to be the 1806 one were it not that Bishop, in a list of furnaces in operation about the year 1860, mentions a charcoal one of Peter Townsend & Co., built at Southfield in 1839. The furnace in the photograph may therefore be identical with the latter.

*His "History of Iron and Steel in All Ages," with the authorities cited, has been of great assistance in preparing this article.

AUGUSTA IRON WORKS AND RAMAPO MYTHOLOGY.

Reference has been made to the establishment founded by Capt. Solomon Townsend, in 1783-4, at Augusta Falls, on the Ramapo river. As stated in Spafford's New York Gazetteer of 1813, there was a bloomery in a stone building 70 feet long with four fires and two hammers; an anchory making 60 tons annually of anchors weighing up to 6,000 pounds, a grain mill and sawmill. On the ridge was a cistern, 70x8 feet ground plan, 10 inches deep, for fire protection.

More than fifty years ago, Mrs. Elizabeth Oakes Smith, quite a popular novelist of her day and generation, undertook to romance upon the iron works of the

FIG. 12. WATCHING FOR THE SALAMANDER.

Ramapo, in a book called "The Salamander" or "Mary and Hugo." This was written in a gushing style which would not commend itself to the modern publisher or reader, but which was doubtless considered very beautiful by the public to whom it was addressed, and the volume is still interesting for its local descriptions. The story is based on an old superstition that if furnace fires were not extinguished at least once in seven years, a salamander would come forth and burn his way through the bodies of the workmen, leaving their fragments scattered on either side. This would appear to have been an actual tradition of the neighborhood. It is said by Mrs. Smith to have originated more than 1,000 years ago among the Hartz mountains in Germany, to which country we know the early American iron industry was heavily indebted for personnel as well as for processes of manufacture, many hundreds of German immigrants having been brought over by Peter Hasenclever alone. She gives the information that an animal of the species mentioned was once transfixed by a thunderbolt and might thereafter be seen on one of the Ramapo mountains writhing in flames whenever a thunderstorm passed over. Her book was embellished by that distinguished American illustrator, F. O. C. Darley, and its frontispiece is a view of an old forge which even in her day was a vine-clad ruin. (See Fig. 10.) Mrs. Smith stated that this ruin was then upward of a hundred years old, which is manifestly a mistake, for it is almost unquestionably identical with the Augusta works of Solomon Townsend, which view is supported by Lossing, who published a sketch of the old wall in his "Pictorial Field Book of the Revolution."

Guided by the illustration (Fig. 10) and some information picked up in the neighborhood, I readily found this ruin (see Fig. 11) still standing between the Erie railroad track and the river on the stretch from Tuxedo to Southfields station. The wild appearance of the spot has changed comparatively little in the last half century, though a portion of the arch has fallen or been torn down and a water pipe has been laid along the valley. Abundant evidence of iron working is found in the soil. In the photograph the waterfall is concealed by the wall, and though this cataract may not be so impressive as the sketch would imply, I do not think there is any mistake in the place. Eager said in his old history of Orange county that there was a perpendicular fall of 20 feet, while within half a mile below there was a continuous descent of 75 feet more. The available hydraulic power is, or then was, great, but from the death of Solomon Townsend, in 1811, it has paid little tribute to utilitarianism, and even the practical features of the valley have now surrendered to the picturesque. At present the land belongs to the Tuxedo Park Association. The ancient arch can probably be descried from a car window.

This ruin seems to be regarded by some as the forge where the West Point chain, in whole or in part, was wrought, which is inconsistent with what has been said above.

Artist Darley had a quaint conception of old-fashioned Ramapo furnacemen, as may be observed in his sketch reproduced in Fig. 12. The vaulted and arched design of the furnace, however, was not far astray.

The Ramapo region is a great place for legend and story. At Sterling lake I heard a tale something like this: An eccentric local personage of some years back had a fancy for prospecting about the mountains in search of silver mines, and he also went to digging for a buried crock of gold near the Augusta works. Once he struck his shovel on an iron plate under which the crock was buried. Just then something or other extraordinary

happened and, when he came to, his find had vanished. I was curious to ascertain how he knew that the crock was under the plate, but on this point could obtain no information. Probably the gold had been hidden there by the ubiquitous Capt. Kidd, cruising up the Ramapo on a freshet like that of last fall. It is further understood that the local individual referred to once discovered imprisoned in a mountain cavern an Indian who had been there for I don't know how long. There is a particular cleft where for many years a ticking was heard to come from a watch dropped in by Washington, though the incredulous affirm that it came from percolating water. Doubtless as good material for legend could be developed from "Baron" Hasenclever and his German miners and iron workers as has been supplied by Hendrick Hudson and his Dutch mariners.

A final note may possibly throw some light on the salamander legend. There is a certain ore found in the Walkill valley which sometimes contains 46 per cent. of iron, 16 of zinc and 17 of red oxide of manganese. The Franklin furnace was built to smelt this mineral—which has received the name of Franklinite—but unsuccessfully; for when mixed in a proportion exceeding one-tenth of the magnetic oxide of iron there resulted a refractory oxide of iron and manganese which caused the loss of the furnace charge, destroyed the hearth and required ten or twelve oxen to drag away the useless mass, which was called a "Salamander."

A bill has been introduced in the New York Legislature looking to the adoption of a standard for fire-engine hose couplings to be used throughout the State. It is to be hoped that it will pass and that other States may do likewise.

Letters From Practical Men.

Methods of Die-Making.

Editor American Machinist:

Of the numerous articles on diemaking that have appeared in the AMERICAN MACHINIST of late, nearly all of them have been descriptions of the dies and of the work which they were to perform, and not much has been said about the details of the work involved in making the dies. When I first worked at diemaking I used to search the AMERICAN MACHINIST for every article I could find on the subject, and I was much benefited by them, especially where something was said about how the work on the die was done. I hope this letter will interest the beginners and prevail on the older ones to say something of the way in which they make their dies.

With the vertical milling machine, or the vertical attachment on the universal, most dies can be made more accurately by taking advantage of their movements than by using the templet to lay out and work to. The die here shown, Fig. 1, was laid out and drilled at the same time with the vertical attachment on the universal machine, it being necessary that it should be accurate so that the blanks produced would assemble correctly.

The die being in two pieces, it was first planed and fitted into the shoe and in this it was trued up on the milling machine table, by using an indicator, and then it was brought into position for drilling the first hole *a* (shown dotted) which was for the 1-16 inch radius at *A*, Fig. 1.

The dials were then both set at zero and the hole was drilled about 3-16 inch deep (afterwards drilled through on a drill press). The table was then moved forward .161 inch and then .1875 inch crosswise, and the hole at *b* was drilled; then moving back .1875 inch to the center and .1875 inch to the other side hole *c* was drilled. Moving back to zero and forward ½ inch and .1875 inch to each side of the center line, the holes at *d* and *e* were drilled. Coming again to the center and ¼ inch forward, the 7-32 inch hole *f* was drilled, bored and reamed. This hole was used to pilot the gage, Fig. 2. The boring tool used is shown at Fig. 3. The table was then moved ¼ inch forward and .1875 inch to each side, and holes *g* and *h* were drilled, and so on the other holes were drilled across the die.

The die was then taken from the milling machine and the filing templet, Fig. 4, was made by the same method, filed to shape and then hardened in bone. In using this templet the pins *x* and *y*, Fig. 4, were placed in the holes *f* and *i*, Fig. 1, which brought it in position to scribe and afterwards file *A*, and by turning it around it also located *D*.

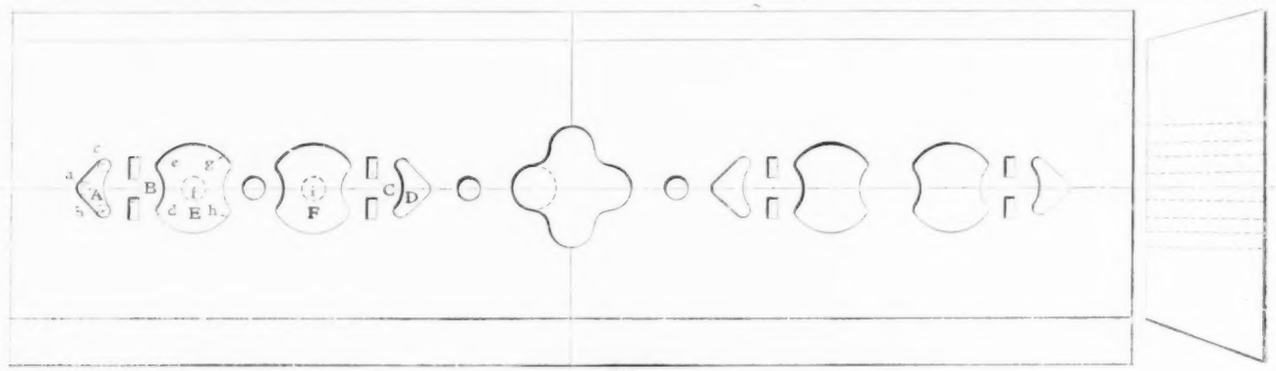


FIG. 1

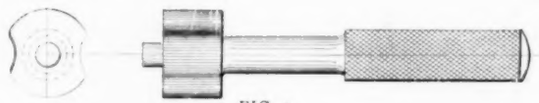


FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

HOW A DIE WAS MADE.

For locating the slots *B* and *C* a templet, Fig. 5, was made, the slot in the templet being used for piloting the gage, Fig. 6. By turning this templet over and reversing it, all the slots were accurately located. The holes *E* and *F* were put in last so as to make use of the pilot holes *f* and *i* in working the others. After filing the die so that all the gages would fit, it was ready for hardening, and when completed it varied .0005 inch over all from being exact size; in hardening shrank .004 inch.

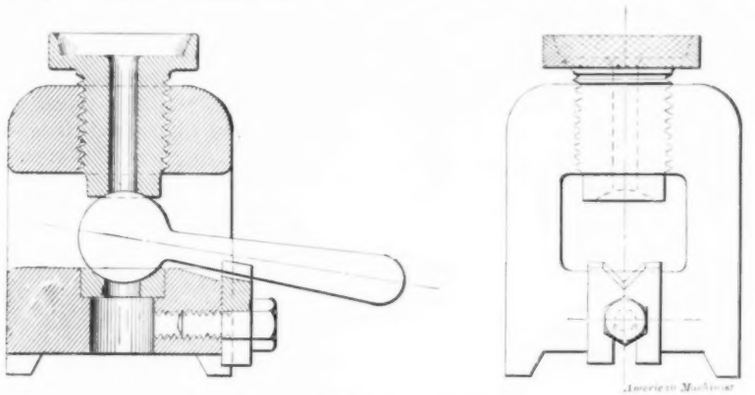
E. S. C.

Jig for Drilling Ball Handles.

Editor American Machinist:

We required a jig for drilling ball handles. I had a faint recollection of having seen one for a similar purpose described in the AMERICAN MACHINIST some

time back. The firm by whom I am employed regularly take in the AMERICAN MACHINIST, and every year the numbers are bound and placed in the drawing office, not solely for the draftsman's use, but for anyone in the works who cares to make use of them. So it was an easy matter for me to look up what I required. The jigs I found appeared to me to be too expensive, so I designed the one shown in the accompanying sketch. As will be seen, the screwed bush acts as a drill guide and at the same time as a



JIG FOR DRILLING BALL HANDLES.

means of holding the work in position. The top is hollowed out for conveying soap-suds to the drill. The top of the pad upon which the work rests has the same radius as the work, which prevents marking or marring the surface. We drill four different sizes of handles on this jig, and for each size we have a separate drill guide and pad. The small notched plate at the side gives the required angles.

CHERRY RED.

Coventry, England.

Draftsmen's Scales.

Editor American Machinist:

It is, I think, many years since an article signed by one of your former editors—Mr. Lewis F. Lyne—has appeared in your columns, and the communication from him at page 318 must have awakened in others, as it did in me, a train of reminiscent thought.

While some of Mr. Lyne's strictures upon the conventional draftsman's scales are sound, I cannot agree with all of them. Regarding the much abused triangular scale, the clamp referred to by Mr. Lyne removes its most objectionable feature and the fact that "this device is seldom used by draftsmen," as Mr. Lyne says, does not alter the fact. With that clamp the triangular instrument becomes equivalent, so far as finding the scale wanted is concerned, to the flat scale shown by Mr. Lyne in Fig. 1, while in form it is greatly superior. The form of the triangular scale is its chief point of merit, as its graduated edges lie at a more favorable angle for pricking off the dimensions than do those of the flat pattern. When made of metal this scale in connection with a prick point—not a pencil—is the handiest of all for pricking off dimensions quickly and accurately. The graduations are of substantial depth and in metal, and by placing the prick point in the desired groove accurate measurements are obtained almost mechanically. I have used such a scale (with the clamp) for years and, in spite of some other faults, I prefer it to any flat scale made. Of these other faults the chief is the one mentioned by Mr. Lyne—the graduating of two scales on each edge, and of this nothing can be said in defense except that it doubles the number of scales on a given instrument. This fault, however, is one of the graduations and not of the triangular form, which form remains, in my opinion, superior to that of any flat scale. Moreover, the triangular scale has it in common with the flat scale.

Regarding Mr. Lyne's proposal that the end of the scale be at the end of the instrument, I can see nothing in its favor. In laying down dimensions on a drawing board the measurements are commonly made from a line or a point, and for such use the scale as commonly made is distinctly superior to Mr. Lyne's scale. In fact, Mr. Lyne's illustrations show that to use his scale it is necessary to use the T-square and in many cases the T-square and a triangle in combination with the scale—that is, his scale requires the manipulation of two and often three instruments instead of one.

In taking dimensions from Mr. Lyne's scale with the dividers, one leg must be set at a line, say, one inch from the end, which certainly seems a left-handed sort of improvement. For this use, as well as for laying dimensions directly down on the board, his scales seem to me to be distinctly inferior to the usual kind.

I recently saw a set of scales forming part of an outfit of drawing instruments which were presented by an experienced draftsman to a young man who was about to enter a school of engineering, and to my mind they were superior to anything which I have seen and, in short, were little short of perfection. They were of the Brown & Sharpe pattern of metal scale, which has the same advantages as the triangular scale in the angle at which the graduated edges lie to the paper and in the facility for using the prick point as already described. The features of these scales which attracted my attention were, however, the graduations. Both edges of each scale were graduated alike and, by the way, there was a scale of six inches to the foot. Except for the full-sized scale, in which, by reason of its length, that arrangement was impossible, the scales read in inches up to 24 inches and they read from both ends—that is, one set of figures gave the distances from the left-hand end and another from the right-hand end. Finally, upon the inside of one of the legs there was on all the instruments a set of graduations of one-half the scale of the outside graduations, the use of this scale being in setting the dividers for drawing circles. If one wished to draw a 7 11/16 inch circle, he turned his instrument over and set his dividers to 7 11/16 inches by the inside scale instead of mentally dividing 7 11/16 by two, as usual.

I enclose a sketch of the 1½-inch-to-the-foot scale drawn from memory, but essentially correct, though with the ¼-inch marks omitted to permit reduction of size in the engraving. The sketch shows all the features except the divider scale upon the under side. It also shows a feature which the scales did not have but which is mentioned in the next paragraph. Of course the 6-inch-to-the-foot scale had no figures for feet, and in the 3-inch-to-the-foot scale the two gears coincided at the center, the inch graduations covering the entire length.

But one thing seemed lacking to perfection. The two sets of figures lead to some ambiguity when taking off dimensions of about half the length of the scales. Had the figures been made inclined, one set italic and the other back hand, and each leaning in the direction in which it should be read, this would have been avoided.

ANOTHER DRAFTSMAN'S SCALE.

Most of these features—perhaps all except the last—have been described in your columns before, though I doubt if all have been combined in the same instruments. To me their superiority was manifest.

C. O. GRIFFIN.

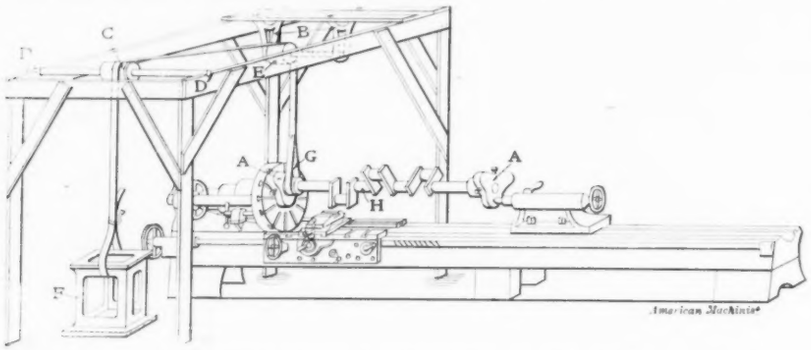
Counterbalancing a Crankshaft in the Lathe.

Editor American Machinist:

There were three cranks, triple throw for 10 inches stroke and weighing about

400 pounds in the rough, to be finished on a 26-inch Draper lathe, and not wishing to make special counterweights for the face-plate I put into execution the following plan upon the suggestion of the foreman:

The crankshafts having been rough turned and the three throws blocked out



COUNTERBALANCING A CRANKSHAFT IN THE LATHE.

on a drill press and Higley saw, the ends were turned to a driving fit in the castings *A A*, which had three hard steel centers equally spaced on a circle of 5-inch radius. These fixtures being driven on and the centers lined with each other were each held in place by two ¾-inch set-screws.

A well-braced, substantial wooden framework was built over the lathe, as shown, except that the end of the frame nearest the observer was fastened to a wall, making it quite rigid. A small horizontal countershaft *B* was then hung vertically over the lathe center line and a piece of shafting with pulley *C* was laid in two notches in the frame at *D D*. The hub of fixture *A* was finished and this was connected by 3-inch belting, as shown, over pulleys *E* and *C* to the weight *F*, which was the inverted table of a radial drill press loaded with enough old iron to balance the work.

The loop *G* was lined with sheet iron riveted to the belt, and with plenty of graphite it made a very good bearing. As the crankshaft came down towards the front of the lathe, its weight of course raised the weight *F*, and, as it moved through the other half of its revolution, the weight raised the crankshaft. As it was an experiment, a few trials were necessary to get the rig into running order. At first the loop *G* was swung about the work at *H*, but this caused it to spring so that the pin was turned about 1-64 inch out of round, the shaft being 3¼ inches diameter in all its parts. Moving the support to the position shown in the sketch eliminated nearly all of this trouble, a slight amount of spring being caused by the twist due to the unbalanced end of work. Puttting half the weight on a strap from each of the fixtures *A* and *A* would, in my opinion, have overcome all tendency to spring.

Another very good feature of this rig which appeared upon trial was the taking of the weight off the centers. With the support at *H*, as at first tried, the tail center could be run back out of the center, leaving the work suspended. This of course could not be done when arranged as in the sketch, as much of the weight was put upon the tail center, but by dividing the weight *F* and hanging half from each end the whole strain would be taken from both centers with the exception of that caused by the cut, which would be no small advantage with a heavy job.

G. R. Ant.

Special Lathe Chucks.

Editor American Machinist:

The drawing shows two special chucks for a common lathe or a turret machine, and two special jobs to be done on them.

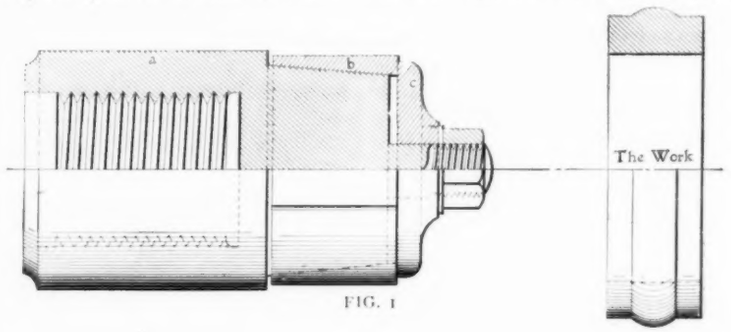


FIG. 1

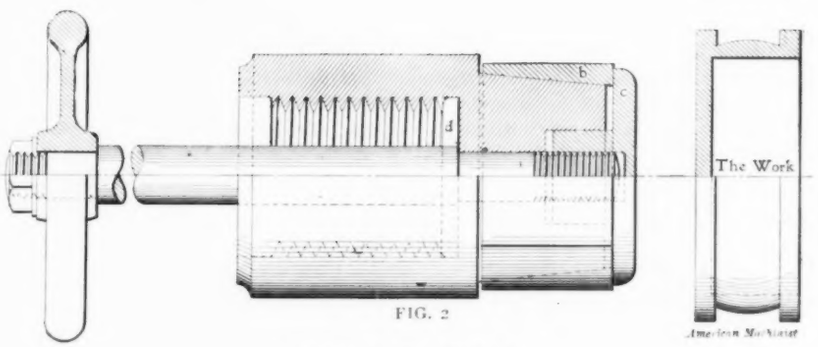


FIG. 2

SPECIAL LATHE CHUCKS.

The job I had in mind particularly when I designed the chuck shown in Fig. 1 was a 7-inch ball-retainer for a large ball-bearing and made of phosphor bronze. The form, though not very particular, could not be finished satisfactorily at one cut with a forming tool and in a common lathe chuck, as the latter would not hold and the jaws would mar the work; besides, after this operation, the piece would have to be turned and the other side faced. I tried a large mandrel, which worked all right, but took considerable time to change from one piece to another.

The chuck is very simple, but satisfactory, it holding the retainer without slipping while the outside is being formed at one cut, and also allowing both sides to be faced simultaneously with a forked tool.

The body *a* is made of a piece of machinery steel, bored and threaded at one end to fit the spindle of the lathe, the body then being finished in place on the spindle. The taper should be such that the expansion ring *b* will release easily. Anyone can use his own judgment in regard to this point. The thread on the stud on the ones I have made is ¾"-10.

The part *c* is a little smaller in diameter than the expansion ring, which was bored to suit the taper on the body, and then finished in working position about .0015 inch smaller than the hole in the piece to be machined. After the ring was sized it was taken off and split with a 1-16 inch saw. You can handle quite a range of sizes by increasing or decreasing the diameter of this expansion ring. I have found that a straight ring bored to fit over the expansion ring gives very good results. I made one ⅝ inch thick with eight slots cut in it, four from one side and four from the other and one cut clear through, and that gave me a range of about 1½ inches. I also made one 10½ inches long for turning the outside diameter of internal gear blanks.

A little later I had some cast-iron caps to make, like that shown in Fig. 2, and as the chuck just described saved so much time, I made another one for this job, the principle being the same, except that the

tightening was accomplished by means of a rod passing through the hollow spindle of the lathe.

The rod has a shoulder at *d*, so that when turned by the hand-wheel it draws back part *c* to expand the ring *b*. If the rod is smaller than the bore of the spindle a bushing can be fitted at the rear end to steady it. While the hand-wheel is convenient, it is not absolutely necessary, as a piece of cold-rolled stock can be put through the end of the rod to operate it.

For holding on this chuck some rings which had to have an internal thread cut to within ½ inch of the end, an expansion ring was made which was counterbored at the front, so that the outer face of drawback plate *c* came flush with the edge of the ring and out of the way of the tool.

OREL B. FRENCH.

A Drawing Office Cabinet.

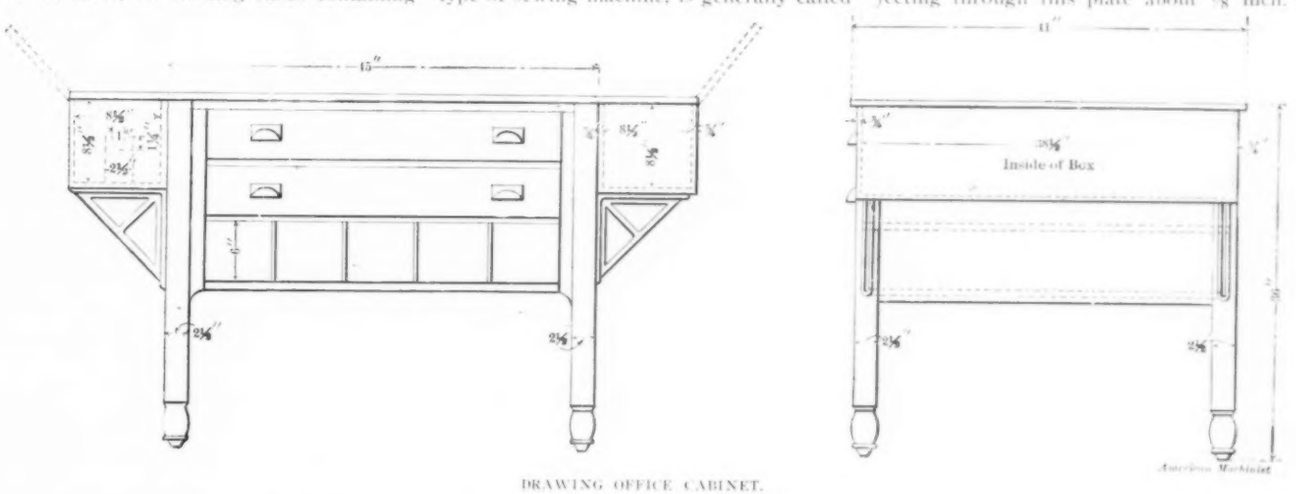
Editor American Machinist:

Being in need of a cabinet for holding detail paper, tracing cloth, blueprint paper, etc., and not finding anything on the market that suited, especially as to price, I designed the one shown in the sketch which we had built by a local concern at a moderate price. As we have since found it extremely convenient, and entirely satisfactory, I offer it to others who may be in need of a similar article of office furniture.

The boxes at the end are arranged to hold the rolls of detail paper, and tracing cloth wound on rollers, the ends of which rest in the supports shown by the dotted lines in the end view of the box. Two drawers of ample dimensions are for holding cut sheets, layouts, etc. Below are five pigeonholes extending the full width of the table, for holding tubes containing rolls and cut sheets of blueprint paper. A couple of brass strips ½ inch wide by 1-16 thick, and 1-16 apart, let into the table at either end, serve as a guide for the knife in cutting sheets. The drawers are 37 inches wide by 30 inches deep inside. The pigeonholes are closed at the back. The box lids should be hinged to fall back without injury to the positions shown.

This cabinet, made of plain oak, filled and varnished, makes a very durable and inexpensive piece of drafting-room furniture.

S. BLISS.



DRAWING OFFICE CABINET.

A Spring Winding Fixture.

Editor American Machinist:

Fig. 1 shows a small wire spring having a straight extension about 2 inches long with a small, round ear formed at the end, the other being bent across the center of the coil, as shown. It is made of light gage music wire, and, as it is used for taking up the slack of the thread in a certain type of sewing machine, is generally called a tension spring. The number of springs required not being sufficiently large to justify the expense of a special automatic machine for making them, a small, cheap fixture had to be designed for the purpose, which, while not making them as rapidly as an automatic machine, would yet produce them cheaply enough to enable the company to sell them at a reasonable price.

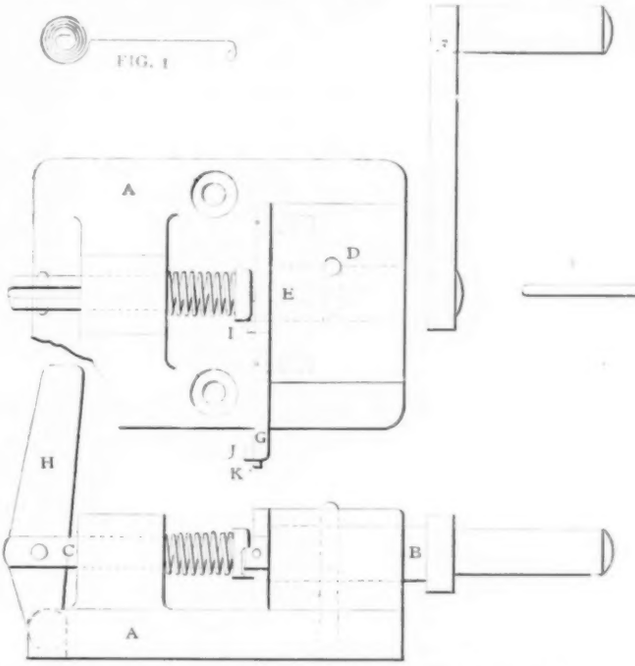


FIG. 2. SPRING WINDING FIXTURE.

The sketch Fig. 2 shows top, side and end view of the simple fixture. As will be seen, the body is composed of a cast-iron block *A* which may be fastened to the bench with screws, and which is bored out to receive easily shaft *B* and plunger *C*. *B* is held in place by a pin *D*. A small pin *E* slotted at one end is forced in the end of the shaft and forms the mandrel which engages the end of the wire and on which the spring is wound when the crank handle *F* is turned. Fitting over the mandrel and fastened to the casting with two screws is a steel plate *G*, the mandrel projecting through this plate about ⅛ inch. When the end of the spring wire is to be engaged in the mandrel slot, the lever *H* is pressed back with the left hand, moving back spring plunger *C*, which, when released, exerts pressure on the spring that is being wound and so keeps it from twisting sideways. When the required number of turns have been made, the loose end of the wire is bent by hand over the pins *I*.

J and *K* to form the loop and shape the outer end of the spring, as shown in Fig. 1. The lever *H* is then pressed back and the completed spring taken out sideways and cut from the coil of wire.

H. ROBINSON.

Rig for Boring Duplex Pumps.

Editor American Machinist:

The accompanying sketch I think will prove interesting to some of your readers. I know that the fixture shown is so designed and constructed that duplex pumps can be "set" not in a few minutes but seconds. Under the old method of fastening pumps to the platen of the machine (four-spindle duplex pump borer) "Tommy" could bore (with good luck) eleven 6x4x6-inch pumps in each ten hours. This, at a rate of 30 cents each, allowed him a day's pay of $3.30. With the fixture here shown he could produce twenty-two of the above-mentioned pumps at a piece rate of 17 cents each. His day's pay was increased to $3.74. "Tommy" increased his pay 44 cents per day, while the company was $2.86 to the good, besides being a winner in other ways.

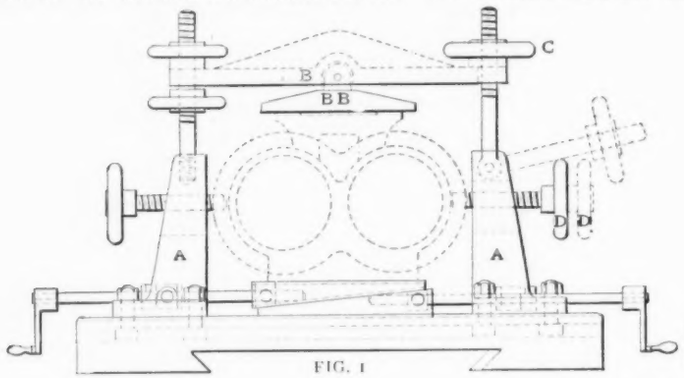


FIG. 1

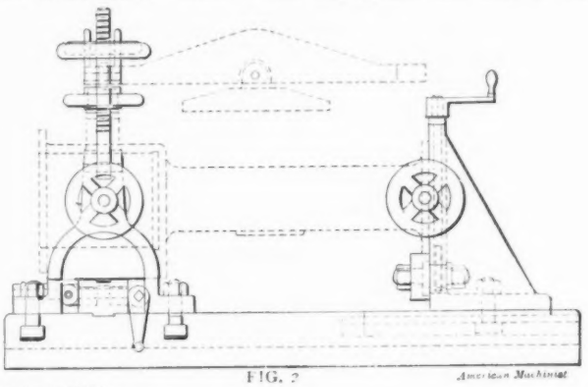


FIG. 2

FIXTURE FOR BORING STEAM PUMPS.

Fig. 1 gives a forward end view of the work-holder. Dotted lines show a 6x4x6-casting set and ready for boring. Standards *A A* have tongues which fit the machine platen, so that they may be moved in or out to accommodate different sizes of pumps, and they are firmly bolted to the machine platen when in the desired position. The left-hand standard is tapped at its upper end to receive a stud of ample size to hold the end of clamp *B*. It will be noticed instead of hexagon adjusting nuts threaded hand wheels are used to do away with the use of a wrench. The lower hand wheel is shown slightly away from clamp *B*, allowing the clamp to be swung out of the way when removing work, as shown in dotted lines in Fig. 2. A swing bolt is used on right-hand side of clamp *B* and hand-wheel *C*, threaded, furnishes all necessary holding-down pressure. In connection with clamp *B* is the equalizer *B B*, the swivel of this clamp allowing the pressure upon the feet of the pump to be equal no matter what the casting condition may be. The steam-chest or valve face (which has previously been (dotted lines) as backed away from the work to allow the pump's easy removal from the fixture. Hand-wheel *C* together with the swing bolt is shown (dotted lines) as lowered to allow clamp *B* to be swung out of the way when removing the pump.

Fig. 3 shows the face of the angle-plate against which the water end of the pump cradle is clamped. The boring of throats and stuffing boxes is of course being done while the steam cylinders are being bored by spindles at the other end of the machine. The boring of throat and stuffing box on the water end can easily be accomplished during the time required to bore the steam cylinders. I think readers will appreciate the fact that the operator of this machine tool is a busy man.

It will be noticed that the cradle flanges rest upon an equalizing support hung upon and adjusted by a screw, as shown with its crank at the top of the angle-plate, Fig. 2. This arrangement allows the steam-chest face to always sit perfectly upon parallel wedges and all the boring is in truth with the planed or milled surfaces regardless of any imperfections of the flanges. Side thrust screws and hand-wheels are used here as on the steam end of the fixture.

A section at *H* is sketched, showing the manner of tightening the clamps against the flange of the pump. The clamp stud runs back through the angle-plate and also through the cam collar. There is a nut upon this end of the stud, allowing finger adjustment to compensate for different thicknesses of pump flange castings. The holes in the angle-plate and also in the cam collar through which the stud passes are somewhat larger than the stud to allow the cam to be moved around to any position best suited to the convenience of the machine operator. The difference in the cam take-up is but 1-16 inch, and with a slight manipulation of the nut at the end of the stud any strain desired can be obtained. It will be noticed that the cam passes just over the strain center, making it self-locking. No wrench of any kind is required or used after the fixture is adjusted, and the simple turning of a hand-wheel here and throwing over of a cam there does the trick.

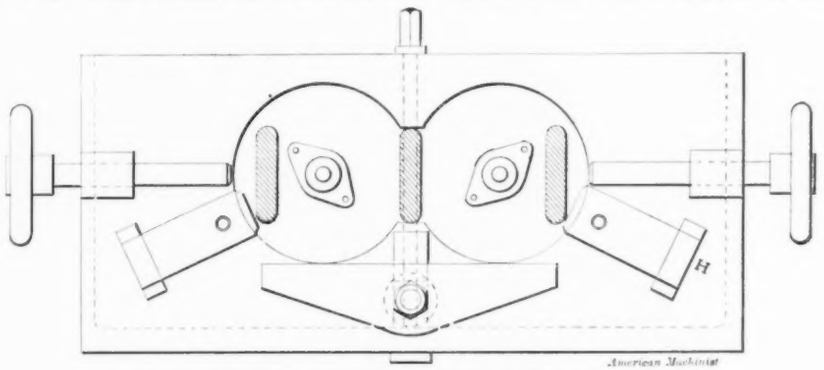


FIG. 3. ADJUSTING AND CLAMPING CRADLE TO ANGLE PLATE.

A saving of 13 cents on the boring of a 6x4x6-inch duplex steam pump means quite a sum when the entire machine work on this piece is expected to be less than 40 cents. Pumps of the above size and smaller were manufactured in lots of 300 or more. I am satisfied "Tommy" could have bored three or four pumps while I have been trying to explain this fixture.

BECK.

A Plea for More Accurate Machine Screws.

Editor American Machinist:

The fondness with which progressive and up-to-date mechanics cling to the use of imperfectly threaded screws and nuts, and to the old-fashioned method of threading them with dies, in view of the fact that much better work can be done in other ways, and about as cheaply, is phenomenal. Should a slight increase in cost appear, the difference in quality and accuracy obtainable more than offsets it.

How many men, in selecting a screw and nut, judge of their fit by the sense of feeling? How do they know they fit? Tap and die makers take the greatest pains to produce their goods according to exacting standards; they (the goods) go into use,

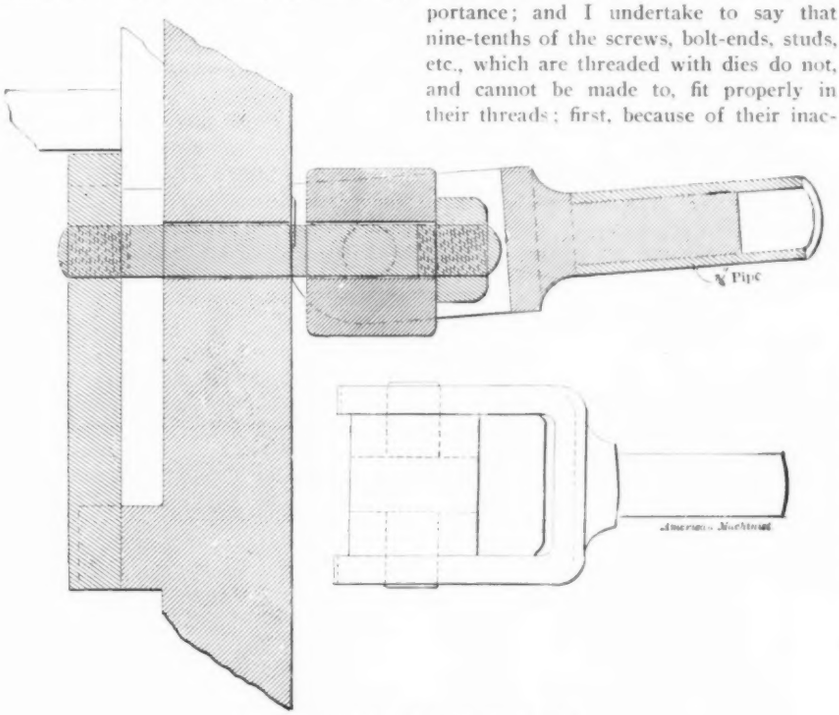


FIG. 4. CAM LEVER CLAMPING DEVICE.

and for a time retain their accuracy within reasonable limits, but soon lose size and form, yet are kept in use until it is fair to say that in almost any shop may be found in the toolroom—in racks next to precision tools and gages—taps and dies that are utterly unfit for further use, and indeed have been so for many months, if not years. Such tools have no valid excuse for living but a very short time at best.

Every day serious accidents (so called) are occurring, through screws or nuts working and jarring loose; everybody interested is surprised, because these members apparently fit so well when put in place. Because considerable power is required to turn them home a "fit" is assumed, when the probabilities are that the accepted fit is a forced one, the metal of one or the other being strained and weakened in consequence.

We use the utmost care to grind and scrape surfaces and secure superficial contact throughout, but when it comes to the threaded fastenings we are lame; if the screw is a little too large, why run it down with an old die until it enters, then apply the wrench and let "beef" turn it home! The thoughtless mechanic takes it for granted that the screws and nuts furnished him are "all right." If he finds taps and dies bearing the size and pitch marks, they too are all "right"; and if he can make the screws follow the taps, and the nuts the dies, everything is "all right," and his conscience is serene, his responsibility discharged.

These remarks are prompted from a lifelong observation of this weakness—for it is nothing else—on the part of otherwise thorough engineers, having charge of work where thread fits are of vital importance; and I undertake to say that nine-tenths of the screws, bolt-ends, studs, etc., which are threaded with dies do not, and cannot be made to, fit properly in their threads; first, because of their inaccuracy of pitch, and second, because of the incorrectness of form due to wear of the dies even while they are still in good cutting condition. This may be disputed, but let us give the reasons:

Upon the accuracy (pitch) of the first tracing or scoring of the thread around the blank depends the final perfection of the finished screw; which is to say that, in transferring the pitch from the lead or master screw to the blank, no influence tending to deflect the threading tool in the slightest should be permitted.

What happens when a die (one not advanced by a leader) is run on a blank? The first chip is taken with a broad, nearly flat point, requiring an unknown amount of force to cause its advance, until the following point enters the wide score previously made; it may be central, and it may not, but its power to advance longitudinally is either imparted by the uncertain hand of the operator, or automatically promoted by the angle at which the points or teeth are inclined. Whatever imperfection the first two or three scorings may have is supposed to be corrected as the sizing and shaping teeth advance, but as each of these teeth must perform its share of the work of maintaining the advance of the die, the chances of a "drunken" thread are very great, and the pitch is usually found to be "off" in proportion to the sharpness of the cutting points. If some are lost or blunted, those remaining intact must do the work of their fellows in addition to their own, and that work is increased many-fold when all cutting power is gone from the incapacitated companions, which must then be forced against metal which they can only bruise.

It may be said that this is an argument for sharp dies; it is more. A die has many cutting points, and should those that remain sharp happen to be opposite to or quartering with the dull ones, the screw will be eccentric or oval, and this is true of dies advanced by leaders as well.

It is therefore contended that die threading is old fashioned and primitive—utterly out of date with the present exacting requirements of accuracy in mechanical construction. It may be said that the "ready-made" threaded work in the market is good enough for a large portion of rough work, such as bridge, railway, wagon and a thousand uses where accuracy is not essential; if so, why has the use of lock-nuts, nut-locks and other devices for retaining bolts and nuts in place become so extensive? If it were possible—and it is nearly so, certainly nearer than dies will permit—to secure as perfect contact on threads as we secure in other members, there would be no need of supplemental devices to insure permanency of position. Expansion and contraction may eventually elongate the male member, but they will not loosen the fit of perfect threads.

Surely it is not necessary to say here that the only way known at present for securing accuracy in threads is to form and finish between centers, with perfect cutting points advanced by means of a lead-screw and positive mechanism; and, so far as machine screws are concerned, those so threaded need cost no more than die threaded, with suitable automatic machinery.

What has been said of die work is applicable, to some extent, to tapped work, but taps have an advantage not possessed by dies: they are more easily kept sharp, and by using them in series the last of the series will hold size and shape longer; they are more readily guided and supported laterally, and may be made long enough to admit of grinding off the ends as fast as the size is lost. If it were possible to trace theads in small holes as it is on external surfaces, it would be most desirable. Tapping is better within the control of the workman, except as regards nuts, which are procured in open market, and even these the careful workman will either thread himself or correct by putting a sizer

through before using on an accurately threaded stem.

Very few machine screws threaded on centers are on the market. The heads are not square with the threaded portion, and in some cases the body hole must be drilled 1-32 inch large in order to line up with the tapped hole or to allow the screw to enter at all.

In the matter of machine screws especially, the conditions are deplorable, considering the possibilities and the machine builder's needs. When the manufacturers of threaded articles give them to us properly made, they may consider themselves abreast of the times; but they are far from it now, for which they are not altogether to blame. It is "up to" the users to demand, and the demand will be supplied. The "good enough" age is fast passing away, but the machine-screw business seems to be bringing up the rear of the procession.

AN OLD MECHANIC.

Machine for Grinding Hand Wheels

Editor American Machinist:

The accompanying photographs show a machine built to grind hand-wheels which have their rims finished for 180 degrees only, as represented in the views.

The wheels are bored in a special fixture, and the hubs faced to uniform length from the center of wheel, so that the grinding wheel may be immediately engaged with the work, at any point of its swing, without danger of encountering enough eccentricity to stall the machine. Two arbors are used to expedite matters.

The yoke holding the arbor upon which the wheel to be ground is placed, is swung automatically through an arc of 180 degrees about twice per minute. On the end of this yoke, and below the bracket holding the same, is keyed a gear which is actuated by a rack reciprocated through the medium of a connecting rod and a stud in the worm-wheel, the latter being driven through worm-shaft and pulley. The work is rotated by worm and worm-wheel, the latter being keyed to the arbor, and the worm-shaft driven through knuckle joints and a gear meshing with a gear on the vertical shaft which has a bearing in the center of the yoke.

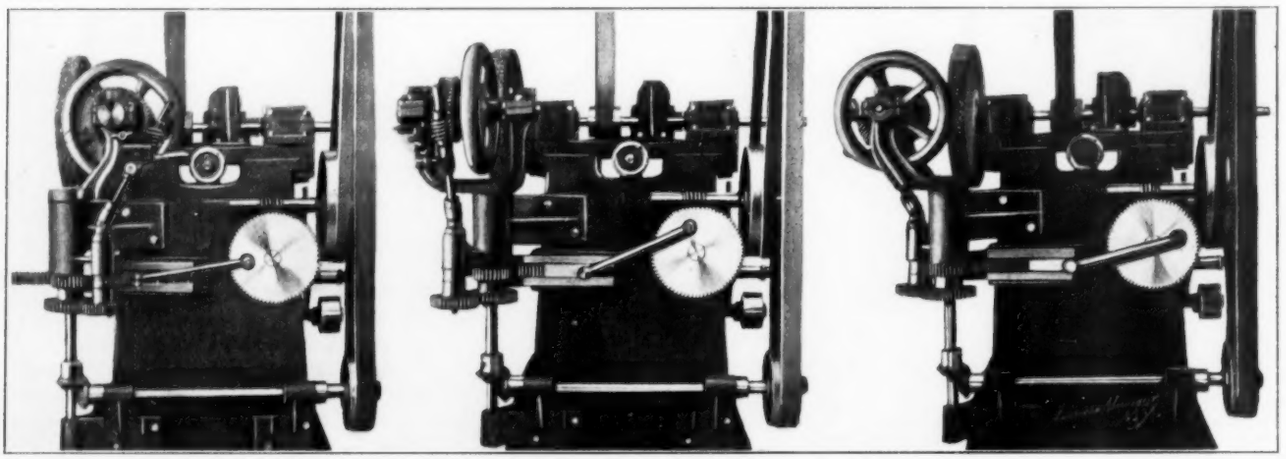
The small hand-wheel shown in the center of the machine is used to feed the grinding wheel to the work. A 2x16-inch carborundum wheel is used. Midway between the end bearing and the pulley on the wheel spindle is mounted a worm which engages with a worm-wheel in the face of which is a pin set 15-16 inch out of center. This works in a vertical slot in a casting bolted to the table and gives the spindle a reciprocating movement in its bearings of 1⅞ inches about fifteen times per minute, which movement not only allows the full width of the wheel face to wear uniformly, but gives a shearing cut to the same and reduces friction in the bearings to a minimum. The cost of the work, as produced by spherical rests and forming tools, was reduced by the machine about 60 per cent.

It might be thought by some that this was an expensive machine to build. Therefore it is deemed proper to add here that the cabinet is from a cast-off wood-working tool, and the only piece a pattern was made for was the yoke, the brackets, etc., being taken from stock.

This machine was built in the toolroom over which I have charge, and according to the suggestions and instructions of Mr. Geo. Holdt, superintendent of the Dexter Folder Company.

THOS. K. EAGAN.

Pearl River, N. Y.



MACHINE FOR GRINDING HAND-WHEELS.

Calculations for Hydraulic Punching and Shearing Machines.

Editor American Machinist:

In response to Mr. Wm. H. Raeburn's article, at page 128, criticising my method of calculating the strength of punching and shearing machine frames, I would like to say that I find his method of calculating the cross-section of the housing more definite than mine, but my article was not intended to show your readers how such parts must be calculated or how they must not be calculated, but merely how such a problem had been solved without excluding other or better ways.

In the first place, attention may be called to the fact that a stress of 4,800 pounds per square inch is not at all too high, when one considers the stress taken in calculating cast-iron gear teeth with V = about 30 feet per minute of 8,000 to 10,000 pounds per square inch. Twenty years ago it would have been thought a crime to calculate cast-iron gear teeth with a stress of more than 3,600 pounds per square inch. The same opinion prevails to-day about shearing and similar machines. As long as the cutting speed is not too great the stress may easily be taken at 5,500 pounds per square inch maximum. In cylinders with internal pressure K = 320 to 600 kilograms per square centimeter or 4,800 to 9,000 pounds per square inch.

Cast iron is done away with in only one class of such machines, namely, transportable riveters; the main reasons being: high end pressure at the last moment, which causes high tension in the material which is not very elastic and which only steel castings can endure; the heavy metal thicknesses which are required in case of cast iron; the high working speed of the piston and the high average pressure in the case of too long rivets which causes springing which is only possible with steel castings, the springing of which in such cases amounts sometimes to as much as half an inch.

With S = 2,600 pounds as a maximum the machines turn out to be too heavy and too expensive. Another fact that justifies taking a higher specific stress is that the formulas give pressures which are never realized even with dull tools or under the most unfavorable circumstances. I am of the opinion that the best and most satisfactory solution of this problem can only be reached on the basis of the theory of flexure by Professors Bach and Tolle.

The methods of correctly and economically designing punching and shearing machines are wrapped up in much darkness owing to the fact that the results of practical tests are very scarce and where

they are in existence they are hushed up and guarded with a jealousy that would be worthy of a better purpose. The only things that the designer of twenty years ago could rely upon were the tests of Dr. Hartig. Just imagine the time in which these tests were made, the quality of workmanship of that time, and one will realize that the machines built in accordance with these tests must have been monstrous in their dimensions.

The tests of Professors Kick and Keller are very instructive, but are taken with such a slow cutting speed that to draw conclusions from them for real working conditions is very difficult. M. Frémont, the well-known French constructor, made a number of tests on lever shears and punches made by the firm of Bouhey, of Paris, which would have been very interesting and of great benefit if made public, but the firm declined to pay the price asked and for this reason the results are still unpublished. The firm Bouhey makes the housings unusually heavy so that any undue strain will injure the slide, the pendulum or the crankshaft, but for this reason the machines are very expensive and consequently poor sellers.

In regard to the calculations of the crankshafts of these machines one is exposed to the same uncertainty and the opinions of experts vary widely. A good many designers are in the habit of making the eccentric stud very short, generally $L = \frac{1}{3} D$, and then calculate the shearing stress only even in gate shears. But this gives in consequence a very high surface pressure up to 10,000 and even 14,000 pounds per square inch and a very high specific stress, generally between 16,000 and 20,000 pounds per square inch, when bending is added even in the slightest degree. This also presupposes such workmanship as can very seldom be found in this class of machines.

In machines with the crankshaft in double bearings and the crank in the center some designers take $P L = 4 W S$, others assume that the load is distributed equally and take $P L = 8 W S$. Even $P L = 12 W S$ was used successfully in the following case:

On a shear for steel blocks 3 inches by 1⅝ inches, the designer, an old practical man, took the crank-pin 4 inches diameter by 8 inches long as he calculated the shearing stress only. The load on the pin was 410,000 pounds, and would have caused a stress of $S = 30{,}000$ pounds, while the surface pressure was 12,800 pounds per square inch. My suggestion was to make $S = 20{,}000$ pounds, the distance from center to center of bearings 17 instead of 20 inches, $D = 9$ inches and $L = 7$ inches with surface pressure $p = 6{,}500$ pounds per square inch.

As the pattern of the housing was already finished and such a heavy crankshaft would have caused the throwing away of many other parts, Professor Englaender, of the Polytechnikum of Vienna, was called on, who calculated the shaft on the basis $P L = 12 W S$, in which L was reduced to 8½ inches, $S = 14{,}000$ pounds and $D = 6$ inches. As a compromise, D was made 7 inches, L 6 inches, and the surface pressure $p = 10{,}000$ pounds per square inch. After the machine was built (1895) its performance gave no cause for complaint. This instance goes to show how widely opinions differ and how much the correctness of calculations depends on quality of workmanship.

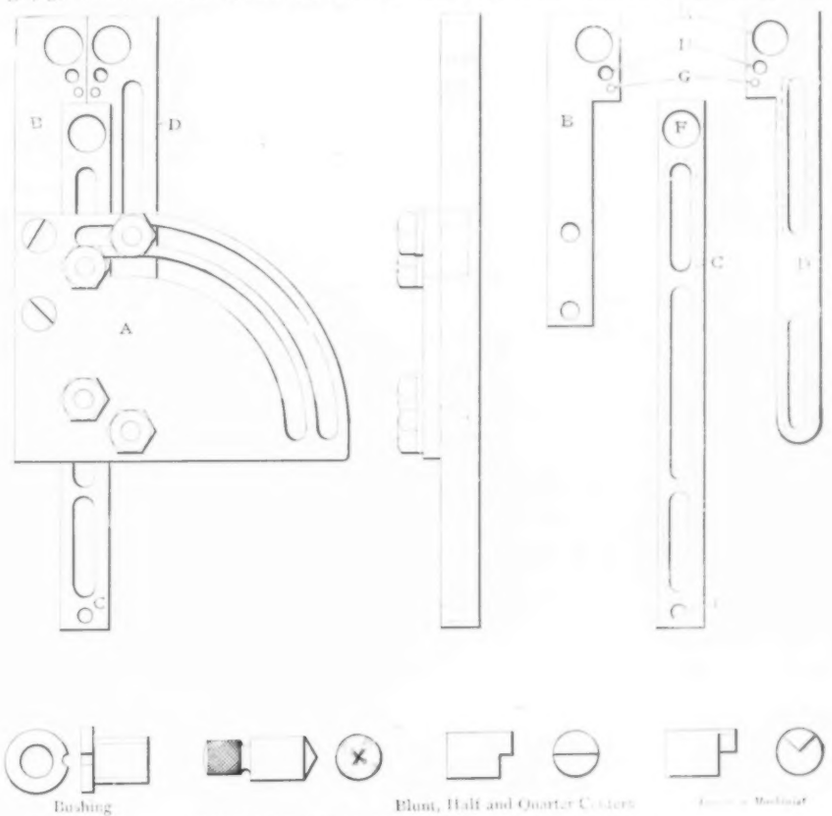
Under any consideration the criticism of Mr. Raeburn is to be welcomed as an exchange of opinion. CHAS. HERZBERG.

Adjustable Tool for Locating Holes in Jigs.

Editor American Machinist:

I am sending you a description and sketch of an adjustable fixture, or drilling jig, which I have found useful, not only as a lazy man's tool, but as a real time saver as well. The tool was originally designed for laying out and drilling holes in jigs, particularly in those cases where, in place of figures, the workman is given a sample piece and expected to reproduce the holes perfectly enough for the product to fit the original machine; but I have also found it handy when one of those hurry jobs comes to me that must be fairly accurate and where time is an important factor; for the device may be set, a temporary bushing or stud made and the piece drilled in this manner in less time than the same amount of work can be done in any other way with which I am familiar.

The fixture is composed of a plate or quadrant A, to which is rigidly fixed, by means of screws, the short arm B. The long arms C and D, which are movable are secured to the quadrant by means of short bolts, and slotted as shown in the sketch, the under side of each slot being counter milled or recessed to keep the bolts from turning and give a flush surface to the jig when assembled. These arms are interchangeable, and adjustable to any position desired. The holes E in B and D and F in C are the ones generally used. In the fixture I am using these holes are standard ½ inch; the greatest distance between their centers being, approximately, 8 and 9 inches, and the least ⅝ and 1⅛ inches. If it is desired to use the fixture for a center distance less than the above, the smaller holes G, H and I must be used, reducing the center distances to a little less than ¼ and ½ inch. A set of hardened bushings with holes ranging in size from 7-16 inch down as small as the usual work may call for, as well as a set of studs, should be kept with the jig.



ADJUSTABLE DEVICE FOR LOCATING HOLES IN JIGS.

To use the tool, a standard plug is inserted in two or more holes, as the case may require, the arms are opened to the necessary distance by a micrometer, or the angle found by means of the bevel protractor; the nuts are carefully tightened and the center distance is again tested. If still found correct, the standard plugs are removed and bushings which should be made a hand fit and kept from turning by a small pin or screw

passing through the flange, are placed in the jig which is now ready for use.

Where one or more holes are to be drilled from one already located, it is necessary to use a stud, one end of which fits the hole to be located from, the other fitting a hole in the jig. When more accurate work is required than can be obtained by drilling, I use this fixture for locating buttons on the work, placing the buttons, which are ½ inch diameter, in the holes in the jig, and using them as bushings for drilling their own screw holes. The buttons are then screwed fast to the work, the jig is removed and it is found that very little adjustment is necessary.

Many odd attachments will become connected with a tool of this nature, such as blunt center punches, square-end studs and half centers, as well as disks which have been used in connection with larger holes, etc.

The tool here spoken of is made throughout of tool steel, with the exception of the quadrant. The slots in the arms are broken by cross ribs, and the whole tool is a remarkably light and stiff device and one capable of being closed into the smallest possible space. This becomes an important factor when the tool is a part of the workman's kit.

MILLARD.

Forming and Parting Tools.

Editor American Machinist:

There are few, if any, diemakers who have not themselves experienced or seen others experience the trouble of trying to finish a radius or formed cut in a piece of work that must be right with a tool made like the one shown in Fig. 1, and, after tightening all the gibs about the shaper, or planer, as it happened to be, find matters growing worse.

The cutting edge *a* is in a plane with the extreme front of the tool shank, and since all cutting tools spring more or less, forming tools generally spring more, in proportion to their length and breadth. When a tool made like Fig. 1 springs, it goes deeper into the cut, and then the trouble is on, the result being an unsightly chattered cut. Now for the remedy. Forge the tool like Fig. 2, with the cutting edge at *b* back of the center. When such a tool springs, it will be away from the cut and no harm will be done. I have made irregular formed tools 2½ inches wide and 12 inches long in this manner, and not a chatter mark could be seen in the work done by them.

Perhaps the best way to make a forming tool for the lathe is to make a cutter from a piece of 3-16 or ¼-inch tool steel, as the case may require, and fasten it to a tool shank, as shown in Fig. 3. The screws seem to absorb the vibration and the tendency to chatter is considerably lessened.

A neat scheme for radius tools, used in the shop where I am employed, is shown in Fig. 4. It consists of a piece of tool steel, of ordinary lathe-tool size, with an 11-32 inch hole drilled through the end, the different sized tools being made with shanks that press in snug. Only one holder is required for any number of tools from 9-16 to 1⅛ inches in diameter. If the end of the holder were made heavier to suit larger shanks on the tools, this style of tool might be used to advantage as large as 2 inches in diameter.

Another tool I want to mention is the parting tool. It might be considered a necessary evil, but nothing has ever been invented to entirely take its place. Its worst fault is its tendency (like the forming tool) to spring deeper into the work. This trouble may be overcome to quite an extent by forging the tool like Fig. 5. I think the extra work in forging is well repaid, especially if the work be on soft steel.

C. H.

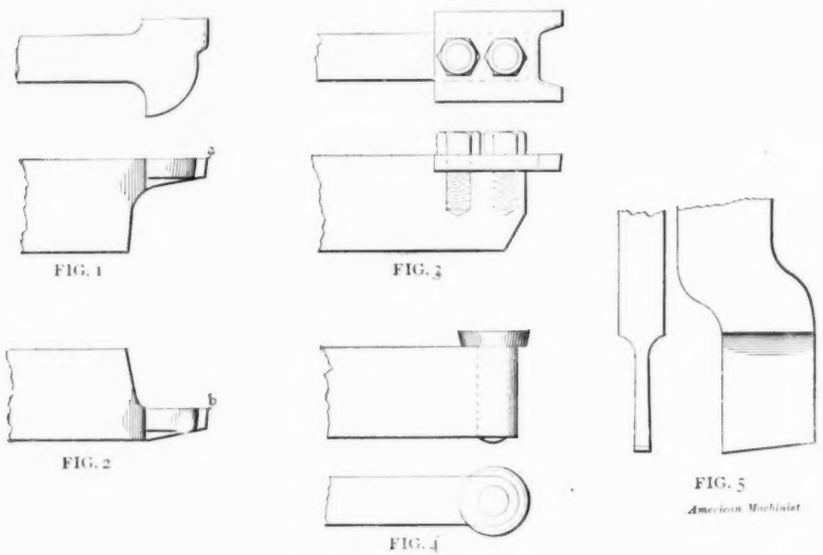


FIG. 1 FIG. 3 FIG. 2 FIG. 4 FIG. 5

FORMING AND PARTING TOOLS.

A Scribing and Hight Gage—Surface Square—Straight-Edge—Micrometer With Thin Anvil.

Editor American Machinist:

At page 118 is shown a scribing and hight gage, and I take the liberty of suggesting one or two improvements: With the front edge of the upright beam graduated in fortieths for a distance of 5 inches, and the upper end of the adjusting screw provided with an indicating finger, the exact hight at which the scriber is set may be seen immediately by glancing at the graduated edge and at the graduations on the knurled adjusting nut. A simple locking device for the screw is a thin knurled nut which may be brought up against the upper face of the slide to clamp the scriber at any desired hight.

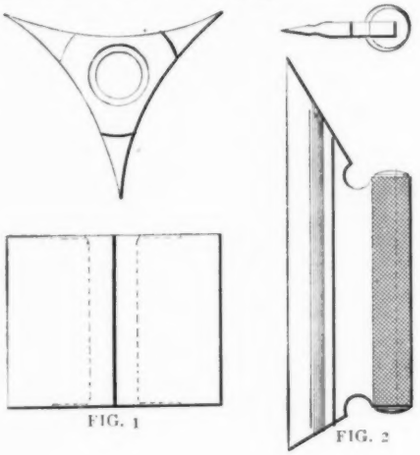


FIG. 1 FIG. 2

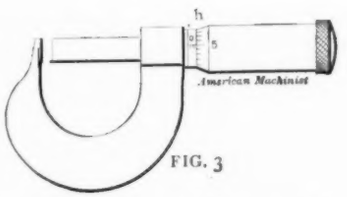


FIG. 3

SURFACE SQUARE—STRAIGHT-EDGE—MICROMETER WITH THIN ANVIL.

The sketch, Fig. 1 shows a surface square which speaks for itself; it weighs only 4 ounces and has, as represented, three working edges. A device which has proven itself very handy on close gage work is a small steel cylinder hardened, ground and lapped so as to stand square on either end. This takes the place of a surface square for round work, it being given a fine coat of unprepared builders' chalk (which can be had at any hardware store) when scraping two surfaces together. The chalk is far better and cleaner to handle than the blue or red preparation now generally used. A few drops of machine oil are placed on a piece of glass and the red chalk rubbed over it; this forms a red paint which does not have that sticky nature which the ordinary red and blue have.

Fig. 2 illustrates a very neat and simple straight-edge having grooves milled in the

sides to relieve the lapping operation which follows the hardening and grinding. It is made of ⅛-inch sheet steel and fitted into a knurled piece of machine steel which has been blackened in oil.

Fig. 3 shows a very handy 1-inch micrometer. We all know how difficult it is at times to gage a certain piece of work accurately. Often it is necessary to make a snap gage, or templet, in order to find the right measurement. Procure a micrometer screw and barrel, such as can be purchased from any of the manufacturers of accurate measuring instruments, and fit into the C-shaped body, which should be made of tool steel, hardened and lapped at the anvil. The micrometer has a more exact and an easier adjustment than is secured by means of the old movable anvil. This is obtained by turning down the barrel about .015 inch on a side and placing over it a thin graduated sleeve *h*. The sleeve is made a tight fit on the barrel and has a small hole drilled near its lower end, so that it may be turned by means of a small spanner wrench to compensate for wear.

A. L. MONRAD.

A Forming Die in a Single-Acting Press.

Editor American Machinist:

The die here shown produces the piece Fig. 1 made of brass .020 inch thick. The blank, 3¾ inches long and 1 7-16 inches wide, shown in Fig. 2, is made in a die of the "follow" type, punching the holes first and blanking the piece at the next stroke.

In this die the blank is placed upon spring pad *d*, the wings resting on *e e* with the pin *h* through the hole in the center of the blank.

When the press is put in motion, the former *a*, which is upon heavy springs, strikes pad *d*, which is upon light springs and forces it, with the blank, down between dies *e e*, which are supported by springs of the same size as those which support the former *a* until *d* bottoms upon

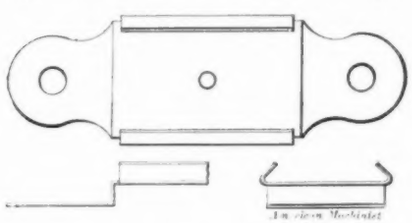


FIG. 1. THE FINISHED PIECE.

holder *f*, when the springs behind *a* are compressed and the ram continues its descent when pieces *b b* force down pads *e e*, and as the die bottoms the wings of the blank are closed in over *a*. At the same time the ends are pressed down past the ends of *d* and are shaped upon *i i* by parts *c c* which are solid upon the punch block. The formed piece remains upon former *a* and is pushed off endwise by the operator.

Holders *f* and *g* are of cast iron and are finished only at top and bottom with the openings for the dies milled as shown. Punch *a* is held in position by the overhanging lips coming in contact with *c c* on the ends and with *b b* on the sides. Pieces *b b* are held by two ⅜-inch screws each and *c c* by one ½-inch screw and one ¼-inch dowel each. *a* is supported by two springs of 3-16 inch wire 13-16 inch outside diameter, holder *g* being counterbored for these springs. All parts are hardened and drawn to a medium straw color.

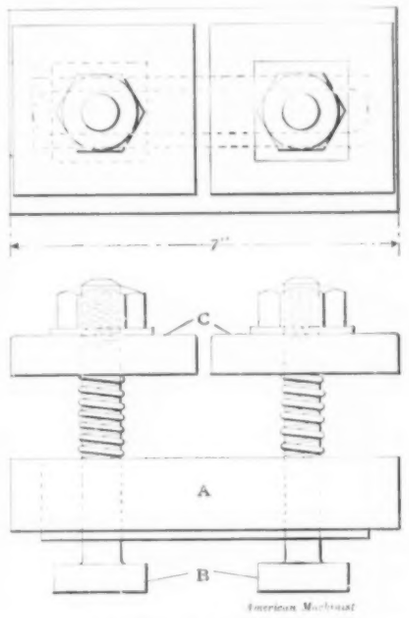
On the lower portion of the die blocks pieces *i i* are fastened firmly upon *f* by one ⅜-inch screw and a dowel (not shown) in each, while *e e* and *d*, being mounted upon springs, are held in position by two round-headed screws in each. The screws work freely in bolster *f* and are screwed firmly to bottom in tapped holes in *e e* and *d*. The screws pass through the springs used under these parts and thereby keep them in position. Bolster *f* is counterbored, as shown, for the springs which are 3-16 inch wire 13-16 inch diameter under *e e*, and 3-32 inch wire wound ⅝ inch diameter under *d*. Parts *e e*, *i i* and *d* are tempered the same as the parts of the upper portion of the die. To avoid confusion in the drawing, the screws through *b b* are omitted in the cross-section of the punch, and one view of the die is shown with section cut off at *j* and screws through *e* omitted. Screws and dowels in *c c* are shown only in one view. This blank is 3¾ inches long and 1 7-16 inches wide.

R. L. C.

A Multiple Tool Holder for the Lathe.

Editor American Machinist:

This sketch shows a simple tool-holder for use in the lathe in connection with Armstrong tools on special jobs where it is an advantage to use two or more tools.



MULTIPLE TOOL-HOLDERS.

Block *A* is made of a hight that insures the setting of the tools well above the center, and is fastened to the rest of the lathe when clamping the tools in position, by bolts *B* and clamps *C*, the clamps being supported when removing or resetting the tools by the two springs as shown. In block *A* a slot is cut to accommodate the bolts, so that when two tools are used on light turning they may be clamped with one bolt near the center of the block.

In turning cone pulleys the compound rest is set at an angle so as to admit of each tool extending the same distance from block *A*.

I prefer this holder to a turret in the turning of gear blanks in the lathe, as the four tools, when properly ground, may be made to rough and finish single gear blanks held on an arbor at one setting, both sides of the blanks being machined simultaneously.

W. J. M.

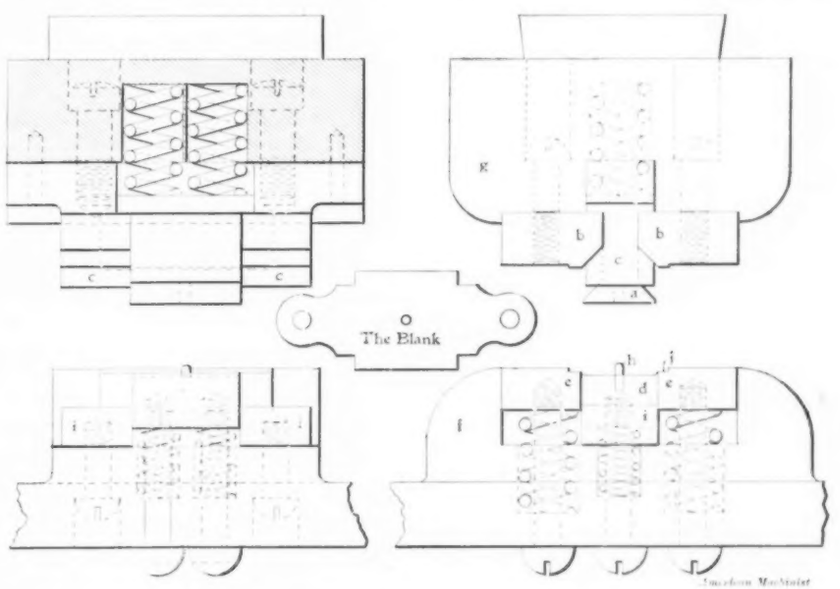


FIG. 2. FORMING DIE FOR A SINGLE-ACTING PRESS.

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Standard Fire Hose Couplings.

As a result of the experience with varying and non-interchangeable hose couplings used by the various fire departments which took part in fighting the Baltimore and the Rochester fires, Assemblyman Moreland, of the New York State Legislature, has introduced a bill looking to the adoption of a standard to be used throughout the State, and it is said that he favors the New York city standard, or at least thinks it would be desirable to adopt that as the standard.

Before this is done, however, we think it will be found necessary to determine what the New York standard really is. At page 866, of Vol. 26, we published an article written by one of the editors of this journal, who is skilled in the matter of standards and has had much experience with them and who undertook to find out the true condition of affairs with respect to hose couplings. His article reveals a condition of affairs which would hardly have been thought possible in any city of a country which has done so much in the science of interchangeable manufacturing and in which so many things are made which are strictly interchangeable throughout the whole country regardless of the shop they come from. This expert was utterly unable to determine the diameter or the contour of the threads on what is regarded by the New York Fire Department as the reference standard for the 2½-inch hose coupling. It is a brass ring, threaded by nobody knows who or when, nor by what tools, and has been used for years without verification or any attempt to preserve it from wear or seemingly with any appreciation of the importance of so protecting it, and whatever its size may be at present no one can tell what it was when made or what it will be in the future. It is of course needless to inform our readers that there should be a set of very carefully made, hardened and ground standards which should never be used for any other purpose except to verify working standards by means of careful comparison. These reference standards should have their proportions determined only after very thorough investigation by experts in such matters, and means should be provided for their very careful preservation from wear or injury. If a standard is to be adopted by the State, then it should be arranged that all new fittings should be made to this standard and for use during the period of transition there should be couplings devised by means of which the old fittings and the new can be used together. This is not a work which can be done by firemen alone, though of course they should be consulted; it requires the advice of someone skilled in standards and in interchangeable manufacture, and he should be employed and paid for making a thorough investigation of the whole subject and reporting upon it. Only in this way can there be any hope of improvement. The present condition of the hose coupling question is simply disgraceful to a country which possesses and adheres to the Briggs standard for pipe threads; in which a standard has been adopted and is generally adhered to for threads of bolts and in which the practical operation of its railroads depends in large measure upon the adherence to certain well-defined standards by every road in the country. The necessity for the adoption of some standard has been perceived before and numerous resolutions have been passed at conventions of firemen adopting certain standards or alleged standards. But after the adoption of the resolutions things went on as before. It is time something were done in a systematic way and in such a manner as to take advantage of the very highly developed skill that exists and the very broad experience that has been gained in such matters during the development of American manufacturing.

Niagara as a Source of Power.

Again a good many good people are being worried at the prospect that Niagara Falls are to be destroyed as a falls and left a dreary and uninteresting precipice by the withdrawal of the water for power purposes. Sentiment, the love of the beautiful and all that have been appealed to without much visible or tangible effect, and now it is being pointed out that the falls, as they are, are a very great source of revenue to very many people because of the money which is brought into the State by those who go by thousands to see the wonders of the place. This argument is expected to be effective with those who can be moved in such matters only by monetary considerations. As a matter of fact, however, there are two sides to this phase of the subject. It is true enough that a good many people interested in railroads, hotels and the supplying of these with what they need to carry on their business derive a considerable income from the falls as they are, but the interests of these people are somewhat diffuse. There is free competition in the hotel and boarding-house business in Niagara and in most of the business by which they are supplied while by no means all of the income that goes to the railroads is reaped by one road or even a few roads. But the men who are after the water of Niagara with the expectation of making power from it to sell to others, hope to gain a more or less complete monopoly of that power and their interest is therefore the more concentrated and in the end likely to be the more effective. The fact is as it seems to us that a great natural creation such as this should be regarded as belonging not to a few individuals to be exploited as they choose, but to the State or National government, and the privileges of deriving power from it or of making use of it in any way should be given only upon terms under which the people to whom it belongs should share in its benefits. The power derived from Niag-

ara is originally developed by the heat of the sun falling upon all that great area tributary to and drained by the Great Lakes. We are inclined to think that the utilization of this power in the service of mankind will be of far greater usefulness and benefit than to merely let the water pour over the precipice as a spectacle, but to allow it to be monopolized by speculative companies who may charge what they please for the power or, what is the same thing, for the factory sites on which the power may be used, is not to utilize the power in the service of mankind, but in the service of a few individuals, and the protest that is being made against this is fully justifiable.

The Metric System in Great Britain.

The House of Lords has passed unanimously the bill making the use of the metric system compulsory in Great Britain after April 5, 1906.

The Metric System Before Congress.

At the hearing of the House Committee on Coinage, Weights and Measures, held March 10, Mr. L. D. Burlingame, chief draftsman of the Brown & Sharpe Manufacturing Company, presented, in the name of the company, a protest against the passage of the pending bill.

The Watt Memorial.

Our readers have no need to be informed of the movement for the erection of a memorial statue to James Watt on the site of the humble cottage, in Greenock, Scotland, where he was born. The movement is international in character, and Americans require no urging to participate, and it is merely for the convenience of those who wish to contribute that this announcement is made. The American committee, of which Andrew Carnegie is chairman and Theodore Dwight secretary and treasurer, comprises the presidents of the four American engineering societies and the heads of other principal representative bodies as follows: Albert R. Ledoux, president American Institute of Mining Engineers; Ambrose Swasey, president American Society of Mechanical Engineers; Charles Hermany, president American Society of Civil Engineers; Bion J. Arnold, president American Institute of Electrical Engineers; John C. Kafer, Engineers' Club, New York; J. D. Farasey, American Boiler Manufacturers' Association; C. L. Salmons, Brotherhood of Locomotive Engineers; J. J. Hannahan, Brotherhood of Locomotive Firemen; W. J. Gitthorpe Boilermakers and Iron Shipbuilders of America; C. L. Shamp, International Brotherhood of Stationary Firemen; R. A. McKee, International Union Steam Engineers; Charles F. Scott, Westinghouse Electric & Manufacturing Company; John H. Converse, president Baldwin Locomotive Works; Charles Allis, president Allis-Chalmers Company; C. W. Hunt, president C. W. Hunt Co.; S. R. Calloway, president American Locomotive Company.

The circular sent out by the committee suggests a subscription of five dollars or less, which should be sent to Theodore Dwight, 99 John street, New York city. Those who thus contribute will receive slips upon which to inscribe their autographs, to become a part of the record of the memorial.

Allis-Chalmers Company—Bullock Electric Manufacturing Company.

The Allis-Chalmers Company has entered into an agreement with the Bullock Electric Manufacturing Company whereby the business of the two companies will hereafter be carried on as that of a single interest. The business of the Bullock company will be conducted as heretofore by its present management under the form of a new Bullock Electric Manufacturing Company.

The Allis-Chalmers Company have just completed a contract with the Turbine Advisory Syndicate of Newcastle-on-Tyne for the manufacture of the horizontal type of steam turbine and now have large and important contracts in hand for steam turbines of 1,500 to 5,000 kilowatts in single units. The syndicate is made up of the following companies and individuals: Willans & Robinson, engine builders, Rugby, England; Yarrow Shipbuilding Company; Tweedie (Vulcan Shipbuilding Company); Hugh Fullager, formerly chief turbine engineer for Parsons; Allis-Chalmers Company. Arrangements have recently been made giving them the exclusive rights of the Western Hemisphere for the manufacture of water turbines and hydraulic machinery under patents controlled by the famous Swiss firm of Escher Wyss & Co., Zurich, Switzerland, and apparatus to the extent of 85,000 horse-power has been installed at Niagara Falls.

They have also obtained from the Nurnberg Machine Company, Nurnberg, Germany, exclusive rights for the manufacture in United States, Canada, Mexico and South Africa of the Nurnberg gas engines for utilizing waste gases from blast furnaces for power purposes.

As makers of mining machinery, the Allis-Chalmers Company succeeded to the business of Fraser & Chalmers, of Chicago, the most widely known makers of mining machinery in the world. The Allis-Chalmers Company also took over the Gates Iron Works, the makers of the well-known Gates gyratory crushers and cement machinery.

The Allis-Chalmers Company as it exists to-day comprises the following well-known manufacturing concerns: E. P. Allis Company, Milwaukee, Wis.; Fraser & Chalmers Company, Chicago, Ill.; Gates Iron Works, Chicago, Ill.; Dickson Manufacturing Company, Scranton, Pa.

The Western plants of the Allis-Chalmers Company are located in Chicago and Milwaukee, the latter comprising two large plants employing about 4,500 men, where reciprocating engines, hoisting engines, flour-mill machinery and sawmill machinery are manufactured. The two plants in Chicago are devoted to the manufacturing of mining, crushing and cement machinery, employing 1,800 men; the works in Scranton, Pa., are devoted to the manufacture of coal-mining machinery, sugar machinery, water turbines and hydraulic machinery, employing upwards of 800 men.

The Bullock Electric Manufacturing Company's plant in East Norwood, Ohio, is the largest manufacturer of electrical apparatus in North America, with the exception of the General Electric and Westinghouse companies. Extensive additions to their shops are now being constructed which will add another shop to their already large number of shops at East Norwood. The new building will contain about 40,000 square feet of space.

This combination of industries will enable either company to bid upon complete power plants, whether driven by steam, water power or gas, and supply not only the prime movers but a complete outfit of electrical apparatus from generators to motors.

The capital stock issue of the Allis-Chalmers Company is $30,250,000 and of the Bullock companies $3,600,000, making a combined capital of $39,850,000. The total number of employees of the combined companies amounts to over 8,700 men. Under the terms of the agreement the payment of the 6 per cent. interest on the Bullock company's preferred stock is guaranteed.

The Premium Plan in British Navy Yards.

We learn with the liveliest satisfaction that the Admiralty have decided to adopt the premium system in the government dockyards. Time has only helped to confirm us in the good opinion of this system, which we formed many months ago, when the whole subject was discussed exhaustively in these columns. The extended use of the system has confirmed the views of its advocates, and confounded the anticipations of its opponents. It is cordially and intelligently accepted by the workmen, and it offers undoubtedly the means of reducing in a marked degree manufacturing costs. Hence its adoption in our dockyards is a matter of moment to the whole country, for it means that a new era commences, and that the navy yards, instead of being as heretofore a glaring example of extravagant labor costs, will set an example of economy to private yards.—*The Engineer.*

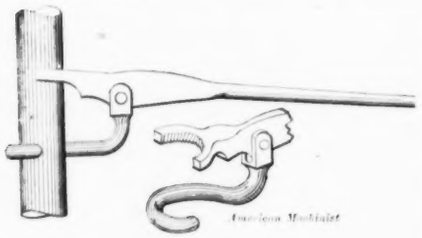
The duty on typewriters imported into Germany is on April 1 to be raised from 13 to 37 per cent. Who will be the April fool? It may shut out the best machines in the world.

Some New Things.

The Metcalf emery wheel dresser described at page 338 in the preceding issue is made by the Heald Machine Company, Worcester, Mass.

A HANDY PIPE WRENCH.

Patents for pipe wrenches issue nearly every week, the cut showing one of the latest. The idea embodied seems to be worth making a note of. The device



A HANDY PIPE WRENCH.

should be a handy one for pipes of some length, but not of much use for short pieces. The shape of the hook might probably be improved upon after a trial or two, or even before that.

A NOVEL MULTIPLE LATHE.

The cut shows the essential features of an ingenious machine recently patented by Thomas W. R. McCabe, Winsted, Conn., for repetitively and continuously turning small work such as occurs in the manufacture of watches and fine clocks. The machine is entirely automatic, except that at one point an opportunity is provided for the operator to remove the finished article and replace it with a new piece of stock to be operated upon. The main parts are a central column and a continuously rotating circular table upon it. The table is driven, as shown, by the pulley *a*, Fig. 1. Attached to the top of the column and standing above the table is a fixed cam-carrying turret, shown in plan in Fig. 3. Upon the flat surface of the table are located six or any other convenient number of lathes of the ordinary type of jewelers' lathes, with the usual spindle, tailstock, frictional driving clutch and chuck. These lathes stand tangentially, equidistant from the center and from each other around the circle, and are in all respects and in all their appurtenances duplicates. Each lathe is driven by an independent electric motor which runs continuously, the spindle being started and stopped by the friction clutch shown at the left in Fig. 2. Parallel with the spindle of each lathe is located the tool-carrying cylinder or horizontal turret *F*. This is rotated as required by lever 18 and its connections, is moved longitudinally by 11, 12, 14 and 15, and radially by 8, 9 and 10. Means are of course provided for holding the turret firmly during each cutting operation. Fig. 4 is a reduced sketch showing how lever 18 is operated. Levers 5 and 6 open the chuck for the release of the work, the chuck being normally held closed by spring 5*a*. The several contact points, 1, 2, 9, 10, 14, 15 are at different hights, giving perfect independence of adjustment for the cams which operate them. The article shown in the lathe in Fig. 2 is technically known as a "clock-pinion," a shaft with three collars. It must be evident that a great variety of work may be done with this machine, and that it is adapted also for much larger work than here shown.

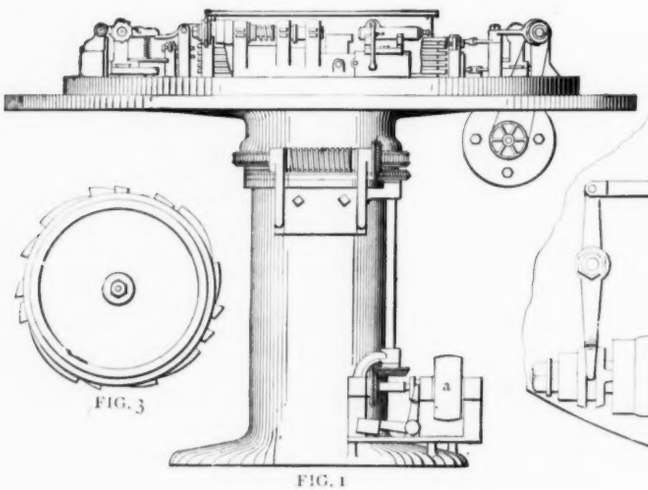


FIG. 3

FIG. 1

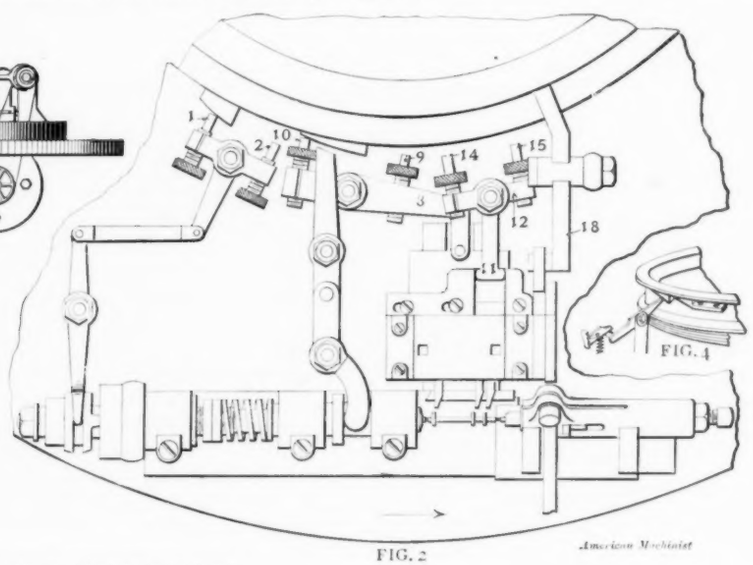


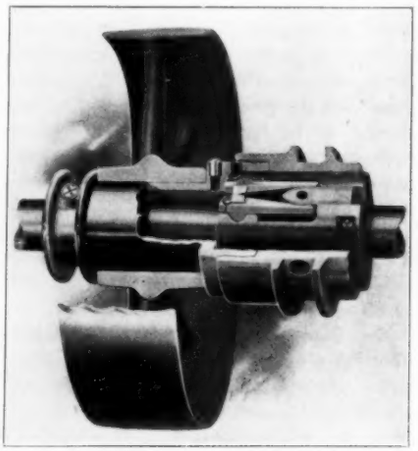
FIG. 2

A NOVEL MULTIPLE LATHE.

FRICTION CLUTCH.

The illustration shows an interesting application of the Johnson friction clutch which has been used so successfully in connection with the Pratt & Whitney friction head turret lathes and which is now being manufactured in various forms by the Carlyle Johnson Machine Company, of Hartford, Conn.

As here represented, the clutch is applied to a pulley, thus converting it into a friction pulley. The arrangement is so clearly shown as to require but the briefest explanation. As will be seen, the body fastened to the shaft carries a split ring in which are inserted a pair of levers. A sliding wedge which is operated by means of the shipper sleeve forces the ends of the levers apart and so expands the split ring against the inner wall of a friction cup which is formed at the end of a shell



FRICTION CLUTCH APPLIED TO A PULLEY.

carrying the pulley. The leverage is such that but little pressure is required to operate the clutch. Adjustment is made as required by means of a screw which shifts the two hardened tool-steel blocks carried at the inner ends of the levers. The adjusting screw is reached by passing a screwdriver through a hole near the end of the friction shell, and it will be noticed that it is not possible to throw the clutch out of balance in adjusting it, *i. e.*, so adjust it as to make its action eccentric or uneven.

For countershafts, or other places where two friction pulleys are required, the clutch is made double ended. It will be noticed that there are no projecting parts to cause accidents, and as all working parts are enclosed they are kept free from dirt.

As the hubs at the ends of the clutch

may be turned to any diameter, it may be used with regular stock pulleys. It is obviously well adapted for use not only in connection with machine tools, countershafts, etc., but also on gas engines and other machinery where a friction clutch is of advantage.

CAR-WHEEL BORING MACHINE.

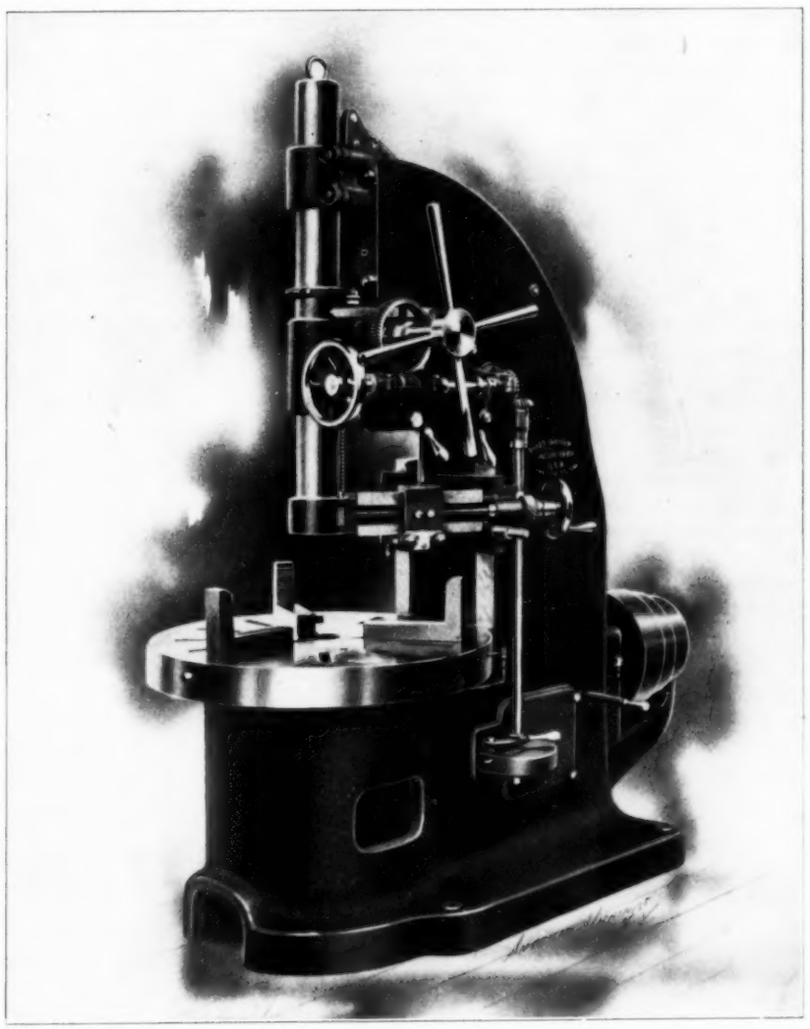
This machine, while designed especially for car-wheel work, is obviously well adapted for a wide variety of boring and turning operations.

It is built in two sizes—36 and 28 inches—which are the same in all particulars, except in the depth of the gap. The boring bar, which is 4¼ inches in diameter and has a vertical movement of 20 inches, is fitted with No. 6 Morse taper socket, and provided with long bearings which are adjustable for wear. It is equipped with quick-change positive geared feed, ranging from 1-64 to ⅛ inch per turn of spindle, and has a hand lever feed, hand worm feed, and automatic depth stop. The facing attachment is of a novel and rigid design, the outer end being arranged to receive a bushing for guiding the tool or boring bar. It is provided with geared feed for facing and hand feed for elevating and lowering.

The spindle is 5½ inches in diameter and has a 2¾-inch hole for chips, or boring bar, through its center. It is provided with taper adjustable bearings for taking up wear. Inasmuch as most of the work which the machine has to do is boring, the speeds at which the spindle runs are comparatively high, and it is therefore mounted on a large and substantial roller thrust bearing, presenting a minimum of frictional resistance and giving in combination with the taper bearing a movement free from vibration.

The table speeds range from 13 to 56 turns per minute, and are derived through the medium of a three-step cone and back gears, the latter being engaged or disengaged by means of a lever at the rear of the column. The chuck is secured directly to the large driving gear, thus eliminating torsional stress in the spindle, and stands 30 inches above the floor.

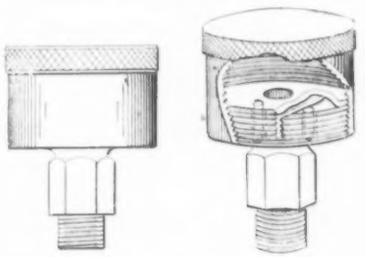
The machine weighs 3,800 pounds, and is built by Baker Brothers, Toledo, Ohio.



CAR-WHEEL BORING MACHINE.

THE CROWN GREASE CUP.

The entire grease-holding chamber of this cup is a cap which is screwed down to press out or feed the grease. The packing ring is of expansible material and is so contrived that when the cap is screwed on the slot in the packing ring is closed, thereby giving a tight pressure against the cap so that no grease can work out to be wasted or to render the cup unsightly.

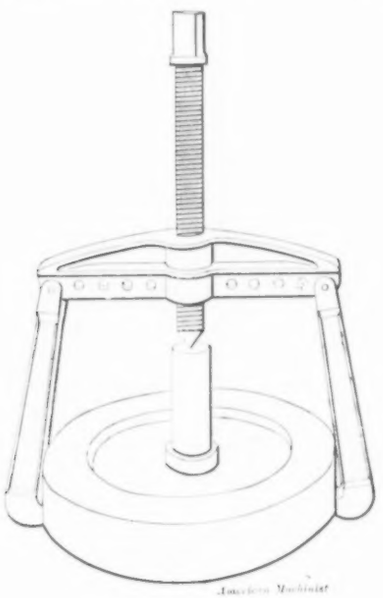


THE CROWN GREASE CAP.

The packing ring has also another feature even more important, which is that the ring is split in such a way that it acts as a check to prevent the unscrewing of the cap. The ring expands sufficiently to prevent the cap from ever unscrewing or shaking off, yet allowing it to screw on as easily as on any ordinary cup. The packing ring also prevents any wearing of the threads from rattling or vibration. This cup is made in seven sizes, from ¾ inch to 3 inches inside diameter, by The Winkley Company, Hartford, Conn.

CRANE'S PULLER.

This new tool for the trade is made for drawing off cams, gears, pulleys, couplings and the like and for forcing sleeves, collars, etc., on or off. It is adjustable for different diameters and can be used also with a short and a long arm to the crossbar, thus bringing the screw out of the center, as when a crank-pin is to be removed. The connections can be reversed so that they will hook inside of the rim of a pulley or gear as well as outside. The cut shows one of its many applications.



CRANE'S PULLER.

It is made in two sizes with different lengths of arms for each. The beams and arms are drop-forged of 15 carbon steel, and the steel screw has case-hardened head and point. Made by Crane & Richardson, 112 Water street, Boston, Mass.

Children or Dollars?

The Child Labor bill pending in the New Jersey Legislature is a measure carefully drawn under the direct supervision of the governor, and designed to replace the law recently declared unconstitutional because of provisions inserted at the behest of the same interests which now appear in opposition. It is a thoroughly proper and reasonable bill, and aims effectually to break up the practice of employing children of school age in mills and factories, and especially at night. It is in line with enlightened legislation in every civilized country, and is favored by everyone save the sordidly selfish body of glass blowers, who would, perhaps, be put to some inconvenience, if the bill were enacted, to find other night helpers than little boys. A delegation from the Glass Bottle Blowers' Association told the committee that they "were in favor of the protection of children, but there was no use in crippling an industry of the State which paid out annually $3,500,000 in wages." Nobody believes that the Child Labor bill will cripple the glass industry, and a labor organization which lends its power and influence to the perpetuation of a labor system worthy of the Dark Ages rather than the twentieth century exposes itself to scorn and contempt.—*Philadelphia Ledger.*

[We do not understand that the Glass Bottle Blowers' Association is a labor organization. It is, we believe, an organization of employers.—Ed.]

A Fire Lesson.

The following, from *Insurance Engineering*, refers to a fire recently noticed in our columns:

"Machine Shop. Brooklyn, N. Y. January 22, 1904. Six-story brick building occupying a city block, of heavy construction, with fairly heavy floors supported by cast-iron or heavy yellow-pine columns and beams. Subdivided by brick walls with openings protected by tin-clad doors. One section of top floor fitted up for office purposes, finished in oak, with false ceiling hung from wooden roof rafters, and several large skylights. Fire started in the office near the division wall and was caused by defective electric wiring. Employees at work at the time and an alarm given from public box. Loss, $60,000.

"The employees tried to extinguish the flames with private fire appliances, but they spread rapidly, due, it is believed, to the inflammable wood trim in the offices, where the fire started. The skylights were not arranged to be opened, as all large ones should be, in order to provide a vent for fire and smoke, and this fact probably accounts for the spread of the flames in a horizontal direction. By the time the public department arrived the entire top floor was ablaze. This building was equipped with thermostats, but there were no automatic sprinklers. It is safe to say that had the construction of the top story logically followed out the approximation of mill construction found in the remainder of the structure, had the hung ceiling been done away with, had a finish of plaster or brick been introduced into the office, had the skylights been arranged (as they should always be when over a large area) so as to open automatically in the event of undue heat, and, perhaps above all, had the building been provided with sprinklers, what proved a damaging fire could have easily been controlled by the employees with private apparatus. It is also important that fire doors shall be kept closed, or that they shall be arranged to close automatically. One report says that unnecessary water damage was caused by chopping holes in each floor."

"Last Monday, March 7, was the seventy-second birthday of the editor of *Fibre and Fabric* and the nineteenth birthday of *Fibre and Fabric*, the editor having been at his desk practically every day of that time and having put to press 992 weekly issues. The editor never recognized a holiday; never knows when they are coming until they are mentioned by someone; every holiday in nineteen years has found the editor at his desk at the usual time. I wonder if such a record of attendance has ever been equaled?"

We are quite ready to concede that the record is unique; at least we hope it is. We are also quite confident that even friend Wade could and would have done more and better work if he had run his human machine with better regard for the conditions which general experience has found to be best.

The current issue of the *Marine Review*, of Cleveland, is the most elaborate number that publication has ever issued. It is a fitting-out number, and is, in addition, devoted to a discussion of the shipping question in all its various phases. The list of contributors upon this subject is unusually brilliant, embracing the Hon. Geo. B. Cortelyou, Secretary of the Department of Commerce and Labor; Senator Wm. P. Frye, of the United States Senate; John McNeil, president of the Brotherhood of Boilermakers & Iron Shipbuilders of America, and Mr. Winthrop L. Marvin, author of "The History of the American Merchant Marine." Hon. T. E. Burton, chairman of the Committee of Rivers and Harbors of the House of Representatives, discusses the system of river and harbor improvements of the Federal Government, and points out some radical defects in it. Col. Thomas W. Symons, member of the Erie Canal Advisory Commission, discusses the enlargement of the Erie Canal to accommodate barges of 1,000 tons capacity from the historical and commercial standpoints. Mr. Harvey D. Goulder, counsel for the Lake Carriers' Association, outlines what has been done toward bringing uniformity in the rules for navigation on the Great Lakes. Mr. W. L. Brown, president of the American Shipbuilding Company, discusses the future of shipbuilding on the Great Lakes. The Panama canal is most exhaustively treated and illustrated with photographs of actual conditions on the Isthmus at present. Detailed plans are published of the engines of the two latest United States battleships "Mississippi" and "Idaho." Detailed drawings are also published of a new revenue cutter for the Maine coast, of a new dipper dredge for the Canadian Government and of a light-draft twin-screw towboat for use on the Mississippi river.

Personal.

H. V. Lewis, formerly with Manning, Maxwell & Moore, has joined the machine-tool department of the Fairbanks Company at New York.

Daniel Nast has assumed charge of the machine-tool department of the Fairbanks Company at New York, having formerly held a similar position with the same company at Philadelphia.

Henry R. Dalton, Jr., has been elected president of the Baush Machine Tool Company, Springfield, Mass., in place of W. H. Baush, resigned, and C. J. Wetzel has been elected treasurer to succeed David Hunt, Jr., also resigned.

B. H. Warren, who was second vice-president of the Westinghouse Electric & Manufacturing Company for a number of years, has been elected president of the Allis-Chalmers Company to succeed Charles Allis, who recently resigned. Mr. Warren is a graduate of the United States Naval Academy of the class of 1875 and saw active service in the Navy until 1878.

Obituary.

Robert G. Holbrook, for the past twenty-five years proprietor of the Vulcan Iron Works, Oswego, N. Y., died in that city, March 11, seventy-five years old.

Edward Howard, the oldest clockmaker in America, died at his home, Dorchester, Mass., March 5, ninety years old. He was the maker of the original and well-known Howard clock. With David Porter Davis he established the first large clock factory in America. They also built the original American watch factory at Waltham. Besides clocks they manufactured fine scales, getting their first orders from the United States Government and from banks for weighing California gold in 1849. They also built fire engines. Mr. Howard retired from active business in 1882, when the clock company bearing his name was incorporated.

Business Items.

The New York Machinery Depot, 178 Broadway, New York, will sell at auction, on April 6, a manufacturing property located at Derby, Conn.

The Wilmarth & Morman Company, Grand Rapids, Mich., has recently received twenty-two orders for its "New Yankee" drill grinders, five of which are to be shipped to England.

A new fireproofing material known as "Ceilinite" has been placed on the market by the H. W. Johns-Manville Company, New York. It is designed for lining partitions, ceilings, side walls and at every point where a flexible fireproof barrier is required, as well as for various other purposes. It is made from specially prepared asbestos, in pieces ⅛ inch to ¾ inch thick, 36 inches wide and about 50 feet long.

Manufacturers.

The Santa Fe will enlarge its roundhouse and shops at Purcell, I. T.

Buck's Stove & Range Company, St. Louis, Mo., is enlarging its works.

The Buckeystown (Md.) Canning Company will install new machinery.

Plans are being made for a repair shop of the Portland (Me.) Electric Railroad.

The Corry (Pa.) Couch Company will build a new plant, to be fitted with machinery.

The Duquesne Motor Car Company, of Buffalo, N. Y., is moving to Jamestown, N. Y.

The Manatawny Knitting Company, of Pottstown, Pa., will build an addition to its plant.

The Elgin (Ill.) Butter Tub Company will erect a new factory building in the near future.

The Thomaston (Conn.) Electric Light Company will rebuild a plant that was burned last fall.

Buildings of the American Spiral Spring & Manufacturing Company, Pittsburg, Pa., have been burned.

The Chase Felt & Paper Company at Cly, Pa., will enlarge its plant and put in additional machinery.

The Sewell-Clapp Manufacturing Company, envelopes, Chicago, Ill., has bought a site for a $40,000 factory.

One million dollars will be expended by the Kaukauna (Wis.) Water Power Company for development, it is said.

The Haak Lumber Company's large mill at Haakwood, a few miles from Wolverine, Mich., has been burned.

The Peninsular Box & Lumber Company, of Menominee, Mich., will build a sawmill at Crivitz, Wis., this year.

The Joliet (Ill.) Manufacturing Company, maker of corn shellers, proposes the erection of additional buildings.

The Central Machine Company, Niagara Falls, N. Y., will erect a factory building, 60x120 feet, two stories.

M. Solmson & Co., Baltimore, Md., manufacturers of weather strips, etc., are preparing to build a new factory.

The American School Furniture Company, New York city, will, it is reported, enlarge its Manitowoc (Wis.) works.

The Westinghouse Electric & Manufacturing Company is reported about ready to enlarge its plant at Newark, N. J.

The P. Hohenadel, Jr., Company, Janesville, Wis., proposes the erection of a $60,000 canning factory at Rochelle, Ill.

A factory for making the J. C. Backus pin-setting device for bowling alleys will be established soon in Smethport, Pa.

Van Buren, Hack & Marvin, manufacturers of the Buckeye traction oitcher, Findlay, O., are building a 100x300-foot factory.

The Petersburg (Ind.) Galvanized Iron Works have been organized with $50,000 capital stock and are building a factory.

A cotton factory at Hampton, Ga., of which Charles Hammock is superintendent, is preparing to put in 3,000 more spindles.

James Dawson, representing L. H. Southhard & Co., has closed a deal for a site for an oak extract plant at Kingston, Tenn.

Radu Foundry Company has applied for a permit to build a two-story and basement foundry at 179 Newberry avenue, Chicago.

Contract has been let to build a 16x42-foot hardening shop for one of the Henry Disston & Son companies at Tacony, Philadelphia.

George J. Moses will erect a new manufacturing building at West Chester, Pa. He is engaged in manufacturing road and break carts.

A four-story office building and new factory building are to be erected by the Winchester Repeating Arms Company, New Haven, Conn.

Dryer & Co., boxmakers, will have a four-story factory built at the corner of West Falls avenue and Lombard street, Baltimore, Md.

The United Lead Company, New York city, has acquired land in Perth Amboy, N. J., for the erection of a plant to cost over $1,000,000.

The Buffalo (N. Y.) Brass & Lock Company will remove to Niagara Falls, where it has bought five lots and will put up a factory.

The Nichols Chemical Company, New York city, has bought a tract of land at Laurel Hill, L. I., for the purpose of enlarging its plant.

The Twentieth Century Heating & Ventilating Company, manufacturer of furnaces, Akron, O., proposes largely to increase its plant.

The Lisk Manufacturing Company, Ltd., tinware specialties, etc., Canandaigua, N. Y., is planning further enlargements, the coming season.

Capital of $25,000 or $30,000 has been subscribed for a furniture factory at Murphy, N. C. John E. Fain is conversant with the project.

Plans have been filed for a stamping shop, 62x44 feet, for D. Lupton's Sons Company, manufacturer galvanized cornices, Philadelphia, Pa.

The Pacific Electric Railway Company, Los Angeles, Cal., is about to make extensive improvements, which, we understand, include a repair shop.

It is stated at Worcester, Mass., that the contract has been let for a carriage factory addition for James C. Stewart, presumably of that place.

The Vincennes (Ind.) Bridge Company is expected soon to erect an addition to its plant, which addition, it is thought, will be about 90x300 feet.

The Emerson Company, Philadelphia, has obtained option on land in South Camden, N. J., with a view of establishing there a big carbonating plant.

An additional $35,000 factory building will be erected for the Velie Carriage Company, of Moline, Ill. It will be 80x100 feet, three stories and basement.

The Hoosier Manufacturing Company, of New Castle, Ind., is preparing to rebuild a warehouse, and it is rumored that the main factory will be enlarged.

Caldwell & Drake, contractors, who have a structural iron works at Columbus, Ind., propose the erection of an addition to manufacture a new line of goods.

The Springfield (Mass.) Gaslight Company has petitioned the board of aldermen for a permit to erect a new building to be used in the manufacture of coal gas.

Contracts have been let for a machine shop to be erected by Henry Van Middleditch, Detroit, Mich. The building will be 50x100 feet, two stories and basement.

A factory in Rakeville, Mass., owned by Lyman Brothers, of Woonsocket, R. I., and used by them in the manufacture of nickel-plated goods, has been burned.

J. C. Williams, of North Carolina, has been in consultation with the Chamber of Commerce, Waycross, Ga., with a view to establishing a mattress factory.

Plans for the rebuilding of the Milwaukee plant of the American Malting Company, on Park and South Water streets, have been approved by the officers and directors.

It is reported at Conway, Mass., that the Burkeville woolen mill, owned by the Delabarre estate and leased by James Hennessey, of Garfield, N. J., has been burned.

A permit has been granted to erect a new $2,500 power-house and engine-room at Sixteenth and Hamilton streets, Philadelphia, for the Baldwin Locomotive Works.

The Commercial Envelope & Box Company, Binghamton, N. Y., has had some thought of building a paper mill, but it will be fully six months before the matter can be taken up.

There is a proposition to build or purchase a factory to supply lasts for the members of the Brockton (Mass.) Shoe Manufacturers' Association, of which T. John Evans is secretary.

Landers, Frary & Clark, manufacturers of cutlery and hardware, New Britain, Conn., are arranging to erect a new five-story building for manufacturing and shipping purposes.

The Planters' Cotton Oil Company, Montgomery, Ala., or substantially identical interests, will erect a new mill of 50 tons capacity to manufacture all sorts of cotton seed products.

Subscriptions are being solicited to the capital stock of $100,000 for a proposed 5,000-spindle cotton mill at Selma, N. C., by M. C. Winston, a banker of that place, and J. B. Hudson.

The F. W. Spacke Machine Company, Indianapolis, Ind., has bought ground with a frontage of 150 feet on Pennsylvania street. The company will erect a large steel structure on this site.

The Sandusky & Southwestern Traction Company will build a main line from Wapakoneta to Kenton and Upper Sandusky, O. Near Kenton, it is said, a large power-house will be constructed.

The American Horse Collar Company, of Holland, Mich., will locate in Ashland, O., where a place in the plant of the Camp Rubber Company is being prepared for it until a new building can be erected.

C. W. McFarlane, proprietor of the Orange (Texas) Iron Works, has decided to erect in Alexandria, La., in the near future a branch plant, to cost between $2,500 and $3,000, which will employ about fifty men.

The New Conklin Wagon Company, Olean, N. Y., is thinking of enlarging its plant, although definite plans have not been made as yet. The company needs more room for the blacksmithing department in particular.

A permit has been applied for by the Triner Scale & Manufacturing Company, manufacturer of scales and sheet metal novelties, Chicago, Ill., for a one-story and basement factory building, at a cost of $8,500.

Workmen are laying the foundations of the Fayetteville, N. C., sub-station of the Cape Fear Electric Power Company at Buckhorn

Falls, to furnish power to the mills and other industrial plants of the city and vicinity.

The Shield Brick & Clay Company, of Willoughby, O., has been incorporated, and a plant with the capacity of 60,000 brick daily will be erected. W. H. Frazer has been engaged in the work of financing the company.

Francis I. McKenna, of the University Land Company, has reported the sale of 48 acres water-front land at Portsmouth (University Park), Ore., to sawmill men of Wisconsin, for a big sawmill with sash and door factory.

The Standard Turpentine Company, which has a plant at Waycross, Ga., contemplates the establishment of a plant at Jacksonville, Fla., where it is represented by W. H. Tomlinson. A company may be formed for the purpose.

The Balcony Manufacturing Company is a new organization, in which several people of the North Side at Minneapolis, Minn., are interested. It is for manufacturing a portable balcony for use in cleaning and painting windows.

The Southern Paint Manufacturing Company is being formed to locate its factory and home offices in Columbia, S. C. Pennsylvania men are interested. Perhaps the Murray Drug Company, of Columbia, can give information.

A movement is on foot to establish a new cocoa and chocolate plant at Lancaster, Pa. The capital is to be $100,000. The Lancaster Development Company has donated the ground. Information may be given by John C. McClain.

The firm of Steele & Condict, founders and machinists, Jersey City, N. J., now composed of N. W. Condict and his son, proposes to erect a three-story brick factory building, but it is not certain just how soon the plans will be carried out.

It is stated at Marion, O., that the Marion Manufacturing Company is incorporating at nearly a half million dollars. It will manufacture threshing machines and traction engines. We suppose this to refer to the existing concern of that name.

The Frantz Manufacturing Company proposes to establish a plant which Cherryville, Pa., expects to get. The main business will be to utilize the Frantz patents on indestructible automobile burners, safety high-pressure boilers and kerosene engines.

The art chandelier and brass works, established less than two years ago by people of the Richmond, Ind., locality, have outgrown their present quarters and will erect a large factory in West Richmond. The capital stock was recently increased to $50,000.

Contract has been awarded for K., La F. & J. roundhouse at Knoxville, Tenn. This is understood to be a part of, or connected with, the Louisville & Nashville Railway. A machine shop and repair department in connection with the roundhouse will follow.

D. W. Archer, of Chicago, has arranged to establish at Streator, Ill., a large canning plant, and a can factory to employ 100 men is proposed by him later in connection with it. O. B. Ryon, secretary of the Streator Improvement Association, secured the enterprise.

Reid Kennedy has been at San Diego, Cal., relative to the selection of a site for the Pacific Steel Company. He has been looking over some of the suburbs with C. W. French. H. H. Peters, president of the Chamber of Commerce, is closely in touch with the steel proposition.

An unspecified emery wheel company at Cortland, N. Y., is thinking of moving to some other place, and Lestershire is trying to secure it. It is expected that 150 to 200 hands would be employed at the new plant. The Taughannock Emery Wheel Company is located at Cortland.

The old novelty works at Idlewood, Pa., which have been closed for a number of years, have been purchased by the Snodgrass Manufacturing Company, of Pittsburg and Allegheny, manufacturer of gas stoves, and will be remodeled. When completed 100 men will be given employment.

A plant for the manufacture of plaster will be started at Charleroi, Pa., by the Charleroi Hard Wall Plaster Company, the promoters of which are W. B. Taylor, J. F. Taylor and J. W. Cornell, of Charleroi. The capacity will be 50 tons daily. A wood fiber department will be added later.

It is stated at Rahway, N. J., that ground has been broken for a new boiler-room and power-house of the New Jersey Steel Company's plant, near "the Junction." It is expected that in a few days ground will be broken for the extensive addition which is about to be built to the main building.

It is rumored in Philadelphia that the Pennsylvania Railroad will undertake about $8,000,000 worth of improvements in Pittsburg. Of this sum about $3,000,000 will be expended on an elevated freight line, and some $5,000,000 will be put into a system of huge eight- and ten-story steel warehouses.

The Miller-Knoblock Electric Manufacturing Company, manufacturer of electrical machinery, South Bend, Ind., has sold to the Charles Kaestner Company its plant and a site of land, 382x258 feet. The plant will be used by the purchasers in the manufacture of automobile supplies. The Miller-Knoblock Company will erect a new one.

S. M. Wilson and W. R. Kinsman, who have been granted a franchise by the Rutland (Vt.) City Council, under the firm name of the Rutland Heating Company, have applied for a charter. The company will be capitalized at $100,000, and a plant will be erected to supply heat and power through pipes.

Articles of incorporation have been filed for the Davenport (Ia.) Washing Machine Company, capitalized at $10,000. The officers will be: President, Julius Krabbenhoeft; vice-president, Henry E. Carstens; secretary and treasurer, Gustav Krabbenhoeft. The company expects to establish a plant at Davenport.

The Rosendale Spreader Company has been organized at Rosendale, Wis., with a capital of $20,000 to manufacture manure spreaders under patents which have been owned by Otto and Louis Seibenharr, of Rosendale. The president is A. C. Perry; vice-president, Louis Seibenharr; secretary, A. W. Marchant; treasurer, Frank Bowe.

A branch of a German concern, to be called in this country the Star Electric Fuse Company is building a plant in the Wilkesbarre, Pa., district, to manufacture electric fuses and blasting apparatus. The German company is represented at Wilkesbarre by J. Schuermann. The manager of the plant will be J. William Murray, from Norwich, Conn.

A company composed of home capital has been formed at Petersburg, Ind., for the manufacture of galvanized iron and metal roofing, guttering, cornices and other tin and iron work. The company will capitalize at $10,000. It includes George M. Bohnert, William A. Braden, W. E. Williams and John H. Viehe. They will erect a factory building.

An ordinance before City Council at Burlington, N. J., granting permission to the United States Cast Iron Pipe & Foundry Company to lay certain tracks, is said to be one of the first steps in the new policy of the concern to enlarge the plant there, and ultimately concentrate its foundries now scattered through the country. It is expected that the improvements will be fully realized in five years.

It is stated at Owensboro, Ky., that the Cotton Plant Developing Company, in which several men of that locality are stockholders, has arranged for the establishment of a factory for the utilization of cotton stalks at Cuero, Tex. M. W. Marsden, of Philadelphia, and Joseph Wile, of Owensboro, have returned from a trip through Texas in the interest of the company.

The American Asphalt-Mastic Company (capital stock, $115,000) has been incorporated in Michigan to manufacture and sell asphalt-mastic, or a composition for paving and roofing, consisting of asphaltum and lime sludge from purification of beet juice in sugar manufacture. The incorporators are Ammi W. Wright, Alma, Mich.; F. R. Hathaway; Roderick A. Gurley, of Denver, Colo., and Wm. H. Worswick, of San Francisco. It is said the first factory will be located at Alma, Mich.

The National Electric Company, Milwaukee, Wis., successor to the Christensen Engineering Company, manufacturer of air brake and electrical machinery, has just moved its executive offices and engineering department to its new building, located at the works. The building is constructed of 2x1-foot cement blocks and is 200x66½ feet. Extensions and improvements are also being made in its shops to supply the necessary facilities for handling the company's constantly increasing business.

The Metropolitan Sugar Refining Company (capital, $5,000,000) has filed articles of incorporation in the County Clerk's office at Camden, N. J. The incorporators are Joseph F. Cotter and I. C. Clow, of New York, and George D. Martin, of Camden. Adolph Segal, of the Metropolitan Sugar Refining Company, when seen at the Waldorf-Astoria, New York, is quoted as saying that the company is going to erect a $5,000,000 refinery on the New Jersey side of the Hudson River, opposite Forty-second street, New York.

New Corporations.

Buffalo Motor Car Company, Buffalo, N. Y.; objects, manufacture motor engines, etc.; capital, $25,000. Incorporators: F. I. Alliger, Tonawanda, N. Y.; F. Wende, Wm. A. Lutz, Buffalo.

Wheeler-Simmons Mercantile Company, Camden, N. J.; objects, carry on the business of manufacturing buckles and harness hardware, etc.; capital, $200,000. Incorporators: Joseph H. Wheeler, Frank T. Carey, Louis P. Kraft.

A. Schrader's Son, Incorporated, New York city; to manufacture submarine armor, machinery and appliances; capital, $400,000. Directors: George H. F. Schrader and Charles K. Cole, New York, and M. Charles Schweinert, West Hoboken, N. J.

Heinze Manufacturing Company, Newark, N. J.; objects, manufacture saddlery hardware; capital, $50,000. Incorporators: Noah Gutter, George Winckhofer and Chas. E. Heinze, all of Newark.

Richford School Furniture Company, of Richford, Vt.; capital, $10,000.

Johnson-Van Vlaanderen Machine Company, Paterson, N. J.; objects, manufacture engines, machinery, etc.; capital, $10,000. Incorporators: Charles H. Johnson, Peter Van Vlaanderen, Cornelius Van Vlaanderen, Paterson, N. J.

Waterhouse Steam & Vacuum Pump Company; objects, making and sale of pumps, engines, etc.; capital, $2,000,000; president, H. L. Cram, Portland, Me.; treasurer, J. C. Drayton, Somerville, N. J.

A Special Screw Press.

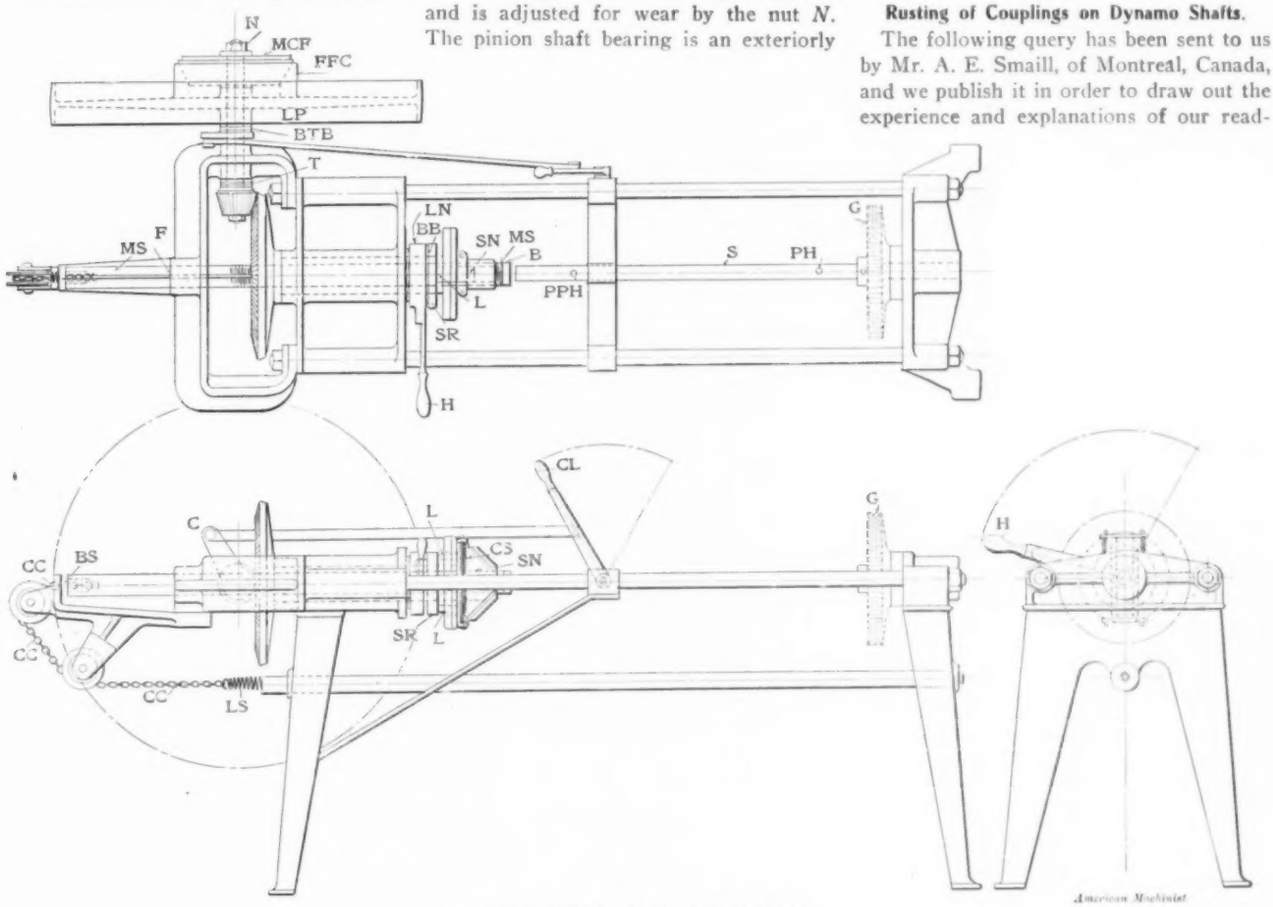
BY S. A. WORCESTER.

This screw press was designed for pressing the 1 7-16 inch cold-rolled steel shaft or axle of a mowing machine into the main gear. It was built to replace a wood frame screw press which had a solid nut and whose main screw was returned to its starting position after the pressing operation by using a hand crank. This press also used a jaw clutch which was more or less unmanageable and the machine in general was nearly worn out anyway and could not keep up with the constant increase of production in the mower department.

The new machine was designed to nearly or quite double the output by its two features of rapid screw travel, with proportionate driving power, and its automatic quick return. The main screw *M S* is splined and held from turning by the feather *F*. The bronze split nut *S N*, which rotates with the main hollow spindle of the machine, is held open by the compression springs *C S*, and its halves in opening and closing move at an angle of 45 degrees with the axis of the screw. The lugs *L L* of the split nut rest when running, or slide when opening or closing, against the steel ring *S R*, which thus receives the thrust of the screw and transmits it through its ball bearing *B B* to the lever nut *L N*. This nut *L N* turns on the coarse left-hand thread formed on the front of the main crosshead or spindle bearing, and when it is unscrewed by pulling the lever toward the operator at the pulley side of the machine, the ring *S R* is forced forward and closes the split nut. The ball bearing *B B* uses thirty-two ½-inch balls and has two hardened steel rings grooved to a circle about 1-64 inch larger diameter than the balls. Flat rings were first tried, but the balls broke occasionally and the grooved rings stopped the trouble and no more balls broke.

The loose pulley *L P* has a female friction cone cast with it and the male cone flange *M C F* has a wooden cone held to it with bolts. The flange *M C F* is held from turning on the shaft by a feather and is adjusted for wear by the nut *N*. The pinion shaft bearing is an exteriorly threaded sleeve having the crank or arm *C* cast with it. It has a ball thrust bearing *B T B* between it and the pulley hub. A ball bearing *T* also takes the opposing thrust between the pinion and the frame. By pulling the lever *C L* the pinion shaft sleeve is screwed outwardly and pushes the pulley with its internal cone *F F C* on to the male cone *M C F*. Two round plugs, with coil springs behind them, in the hub of *M C F* hold the cones apart when the lever pressure is relaxed.

In operating the machine the shaft *S* and gear *G* are placed as shown; the handle *H* is thrown backward or toward the driving pulley, thus closing the split nut and the clutch is engaged by using the lever *C L*. The main screw *M S* now advances and presses the shaft into the gear. In order to bring the pin-hole *P H* opposite the hole in the hub a pin 6 or 8 inches long is inserted in the hole *P P H* and the loose button *B* allows the shaft to be turned to suit during the pressing operation. The pressing is closely watched and the instant the holes come opposite the clutch is thrown out. The split nut is then opened and the long spring *L S*, which is supported by and slides in the pipe below the machine, instantly draws the main screw by its chain connection *C C* back to the starting position. A stout short buffer spring *B S*, in the end of the screw receives the shock of the screw's return.



A SPECIAL QUICK-ACTING SCREW PRESS.

Rusting of Couplings on Dynamo Shafts.

The following query has been sent to us by Mr. A. E. Smaill, of Montreal, Canada, and we publish it in order to draw out the experience and explanations of our readers. Professor Sweet informs us that he has had the same experience, though he has no explanation to offer for it. Mr. Smaill's letter reads as follows:

"Can you explain why shaft couplings on electrical machinery, whether forced on or clamped, always rust between the couplings and the shaft? This point has been brought out very forcibly lately, as we have had several alterations and repairs to make to generators that have been in use for from five to ten years, and in every case we notice heavy rusting at this point. We have never noticed it on car wheels or engine work that we have had to do. It brings out the point whether it would be unsafe to put on the couplings for electrical work without a key. We measured

the fit of one coupling and found that the rust on a 6½-inch shaft amounted to between one and two-thousandths of an inch."

Die for Perforating a Large Sheet.

BY CARROLL ASHLEY.

Our forefathers, or mothers, rather, thought the cast-iron stove a luxury in comparison to the fireplace; but our mod-

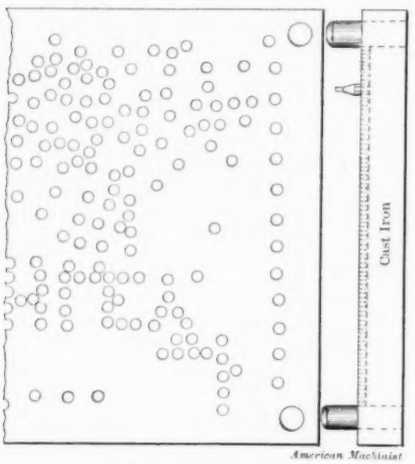


FIG. 1. PUNCH HOLDER.

ern steel range is as much a triumph over the cast-iron stove.

It must have been a laborious task at the beginning to lay out and drill or punch each individual hole and opening in the sheet-steel sides, oven, oven racks, warming closet, etc. But those happy (?) days are over, and if the gigantic improvements continue we may expect to walk into a

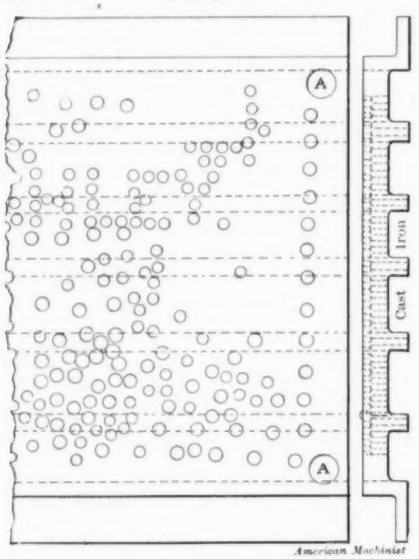


FIG. 2. DIE HOLDER.

stove factory and see boys feeding rolls of sheet metal into machines and the completed stoves tumbling out at the other end, even to the nickel-plating and boxing for shipment.

I would say something of the making of a set of dies in which I took a part, the success of the undertaking demonstrating that it pays to take pains, even to the smallest details, in the building of dies. The firm that made this set of dies had also made another set previous to this which were particularly valuable as scrap iron. In the making of this previous set, as many as ten men worked on them at different times, and several even had the temerity to quit on account of them. In the new set three of us carried the work along to completion, and though we felt that it might be policy to hang our coats out the window when the time came for testing, we were prepared to assert at all times and stages of the work that the job should be right if carefulness in workmanship had anything to do with it.

The greatest number of holes to be pierced by these dies at one stroke of the press was 125; the punch-holders were made interchangeable, and the dies (360) were permanently seated in their holder. The templet, of ¼-inch boiler iron, was sent us already laid out and drilled.

Figs. 1 and 2 give a general idea of the plan of the upper and lower plates. The holes I have laid out in haphazard style, as I do not remember their exact location. One-half only of die- and punch-holders are shown, the full sizes being 30x50 inches.

Fig. 3 shows the shapes of dies, punches and punch-holders. The dies were partially machined on a screw machine to the extent of beveling one end and roughing the diameter to within .015 inch of finish size. In a jig on the drill press a straight hole was drilled through the center .010 inch smaller than finish size. Next a taper reamer was run through in the same jig—and to a stop, so that the smaller end of the hole was 7-32 inch diameter. A lathe next assumed the responsibility of reducing the diameters to correct size, a taper mandrel being used. Next a drill was run in from the bottom for clearance and the dies were hardened.

The punch-holders also were roughed out in the screw machine and a 13-64 inch drill was run through. A reamer like the one shown in Fig. 4 was centered in a lathe chuck and the holes were reamed to size. A 60-degree countersink with pilot, Fig. 4, centered the holders, after which they were turned and threaded on centers, being driven by a driver bolted to the face-plate with fingers straddling the hexagon part. The center in the outer or tapered end was faced off the last thing. These holders were made from cold-rolled hexagon stock.

The punches were made in three different lengths, so that one-third of them entered 1-16 inch of the blank to be pierced before the next third touched the work. When the first third were through and the second third were in 1-16 inch, the last third began their work. The punches were upset at one end to fit the countersink at the threaded end of the holder and the body was made to "just tap in." These holders, carrying their individual punches, could be arranged in "any old" combination desired.

When the dies were tested there was quite a concentration of all eyes toward that part of the die room. How well I remember the superintendent with his sarcastic "phiz." As the upper plate was gently lowered into place he pressed his thumb and forefinger on the plate, to feel it "click" as the punches (in his expectation) "sheared" some of the dies. His words of praise when she failed to "click" were well taken. Many other combinations

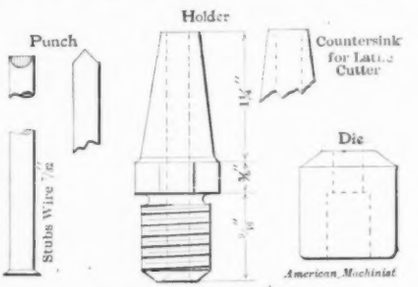


FIG. 3. PUNCH, PUNCH HOLDER AND DIE.

were tried to test the alinement, and nary a click.

Fig. 5 shows the successive operations on the upper and lower plates in detail, from the laying of the templet for spotting the holes in the die-holder to the transfering of the holes to the upper plate and the final screwing home of the punch-holders. The dies were made a drive fit, and when they were put in the lower plate warped about 5-64 inch. It was replaned on the bottom before final testing. The pilots of both taps and counterbores were ground off after the holes were started. The templet was used as a stripper.

Wonderful claims are made for the new smokeless powder, veloxite, invented by Col. Hope, London. It is said to have 73 per cent. more power than the govern-

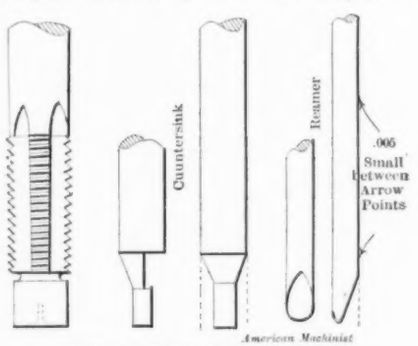


FIG. 4. SPECIAL TOOLS USED.

ment's present powder, contains no nitrocompound, sulphur, phosphorus, chlorate or other dangerous ingredients. The flashing point of black powder is 640 degrees Fahr., that of cordite and all nitro powders from 360 to 370 degrees, while that of veloxite is about 1,200 degrees. Veloxite stands hammering with a sledge on an anvil; chemical action is impossible in any climate for any length of time.

Fan Power for the Cupola.*

BY THOS. D. WEST.

Recent experience in installing a large new fan and power to run it has impressed the writer with the importance of a more definite basis for purchasing the necessary power to run foundry fans. The fan, which, by the way, is a very good one, was purchased to blow a cupola 66 inches inside lining. The power required was given as 45 horse-power, but in order to have a surplus we obtained a 75 horse-power motor. In starting to use the fan all connected to the cupola, we found it required 92 horse-power to give 1,735 revolutions, which was within 300 revolutions of what the fan should run to give its greatest volume of blast. Being afraid of burning out our motor, we at once wrote the fan people and had a man come to investigate the difficulty. He started in by stating that a fan required the greatest power when its gate was closed and criticised points in our piping which we were unable to change at that time and of which not a word had been written by the fan people when we were making inquiries of them as to the power required. We held the position that the motor power was entirely too light for the fan, no matter how the blast pipes were arranged, and asked him to take a test with the fan outlet free of all piping and wide open, as we did not agree with his claim that a closed outlet required the greatest power. This test, which we ran with 1,400 revolutions, took about 115 horse-power.

The expert, thinking to evade the issue, offered to replace the 75 horse-power electric motor with a 50 horse-power steam engine and guarantee it to do the work, if we would furnish the steam; but knowing accurately by the current record what power we were using every minute (something we could not readily test ourselves with steam power), we of course ignored such a proposal.

Since there is now no accepted standard of power to run fans, I hold that the buyer or user should know the power required to run his fan when the outlet is open and closed. This is the greatest and least power that can ever be demanded, as can be seen by tests Nos. 9 and 10 of the accompanying table, which form the only intelligent basis upon which to compile tables.

When a fan or blower leaves the manufacturer's shops, it may go to a plant where conditions as to length and shape of piping, distance of cupola, character of tuyeres, difference in charging of iron and fuel, also their character, will vary greatly from the conditions at any place to which its duplicate may be shipped; and thus the exact power required will be different in every case. If one writes for information on the efficiency of fans, he will likely receive tables showing that certain revolutions will give a certain volume and pressure, and that these latter will bring down so much iron per hour, but not a line about the horse-power required. Should results not tally with what the tables call for, when you get your fan at work and you write a complaint, you may receive a confusing letter in support of the fan tables and claiming that you have something very unusual in your practice. Be this as it may, you are in trouble that could have been avoided had you had the base for a standard herein suggested.

If we can know the maximum power that is likely to be used, as in the case of an accident rupturing the pipe adjoining the fan, and also know the least power required, as in the case where tuyeres are badly bunged up, or the fan wheels are cutting the air, as in test No. 10 of the table, we have two positive factors for a standard that can be definitely and satisfactorily used at the maker's and buyer's shops alike; and this without considering or including a lot of variables that cannot offer anything conclusive and only give cause for contention over conditions that are never alike in any two shops.

The power that is required in the every-day use of a fan or blower will vary greatly from that required to run them with open or closed outlets. Some fans can be found 100 to 200 feet away from their cupolas, with the blast pipe as full of bends as a ram's horn, while others will be within a few feet of their cupolas with few, if any, bends in the piping. Of course the shorter the piping and the fewer the bends the less power required to drive the fan or blower, and the better the service rendered. As an example, we reduced the load on our fan motor about 20 horse-power by moving our fan 15 feet nearer to our cupola and dispensing with two curved elbows as soon as conditions permitted the change. This is only one of the many conditions that vary and that call for a great difference in the actual power required between what a fan will need to run with open and closed outlet.

Some manufacturers of fans and blowers will no doubt object to stating the power necessary to run them open, on the ground that this calls for more power than will be used. This is true in most all cases, but it should not prevent them publishing such data at different speeds for a base to figure from.

As suggestions for rules to provide sufficient power for actual every-day practice from the base of power required to run a fan open and closed, I would subtract the power required to run a fan closed from that required to run it open at any desired speed. For example, I present the following from tests No. 9 and 10:

	Horse Power
Maximum power with speed 1,800 r. p. m. and open outlet.....	144.6
Minimum power with speed 1,800 r. p. m. and gate closed.....	37.2
Maximum power required in actual practice, speed 1,800.....	107.4

A second rule would be to provide a power equal to 75 per cent. of the maximum load with open outlet at any desired speed as follows: 144.6 — 36.15 = 108.45. One rule gives us 107.4 horse-power, while the other gives 108.45 horse-power, a difference of about one horse-power. These are rules which could greatly improve present methods, and such as the buyer could test as well as the maker.

Users of steam power connected with other machinery than a fan rarely know what power the fan is using. If the boiler or engine is found overloaded, the excess over calculations is generally charged to other tools, as the fan people had stated the exact power required. Of course there is a way to indicate the steam power used, but the inconvenience and often expense of such tests prevents many from having them made.

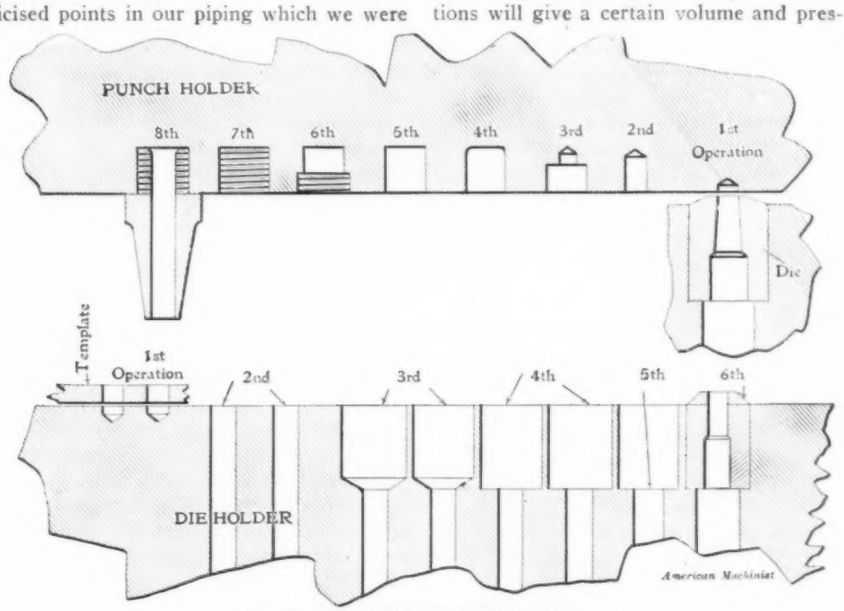


FIG. 5. THE SUCCESSIVE OPERATIONS.

*Abstract of a paper read before the Pittsburg Foundrymen's Association, March 7, 1904.

By the use of electricity one can readily detach machinery other than the fan to find at any moment just the power it requires. This modern method demands most exact knowledge of the actual power a fan requires. Had we shut our eyes to the amperes recorded, or placed full confidence in the instruction of our fan maker, we could have ruined an expensive motor in short order and shut down our works for many weeks to wait for a new motor, all at a cost of hundreds of dollars besides loss of customers.

The foundry business, by the aid of foundry literature, is coming more and more to scientific lines and we should possess a knowledge of the principles involved in the supplies we purchase, as well as of the manipulations on the floor and in the cupola.

No. of Test.	Time.	R. P. M.	H. P.	B.P.
1	8:00 a.m.	1800	120.5	5 oz.
2	10:00 "	1800	101.9	10 "
3	12:00 "	1800	76.7	11 "
4	1:00 p.m.	1800	75.4	12¾ "
5	2:00 "	1800	75.4	13 "
6	3:00 "	1800	70.8	12 "
7	4:00 "	1800	70.8	11½ "
8	5:00 "	1800	70.8	11½ "
	5:30 "	Bottom Drop'd.		
9	Open outlet.	1800	144.6	
10	Closed outlet.	1800	37.2	15 "

POWER AND PRESSURE TEST OF FAN BLAST, TAKEN JAN. 23, 1904.

BLAST PRESSURE GAGES.

There are few things for use in a foundry that are more deceptive if not thoroughly understood, than blast pressure gages. This is owing chiefly to the fact that any increase in the power to run a fan will not always produce like increase in blast pressure, as is seen by a study of the table. Here we find that with the exercise of the greatest power or blast volume we have the lowest pressure and with the least power and creation of volume the highest pressure, thus giving results the opposite of what we should expect from the increase of power. In other words, pressure is often more due to resistance of delivery than to the power used to create the volume. This seeming inconsistency is due to friction in the pipes and conditions of the stock in the cupola, especially that fronting the tuyeres. To demonstrate this was one reason for the tests in which, it will be observed, the speed was constant and the power to run the fan variable.

Test No. 1 was taken after the sand was put in and with no fuel in the cupola, so as to leave free play for the blast through the cupola tuyeres. Here we have the freest liberation of volume of blast that is possible outside of disconnecting the pipes from the fan's outlet and blowing into the open air. In this test the fan requires 120.5 horse-power and we get but 5 ounces of pressure.

Test No. 2 was taken after the kindling and coke for the bed had been fired. We ran but a few minutes, for fear of blowing out the fire. Here, owing to the tuyeres being checked to a greater or less degree by coke, we find the pressure increased to 10 ounces.

Test No. 3 was taken about 5 minutes after starting the blast to melt down the iron, and gave a pressure of 11 ounces.

Tests No. 4 and 5 give us the highest pressure obtained during the heat, and the only way we can explain the lower pressure further on is that after the fifth test the tuyeres must have burned out and become freer, or it may be that the iron was larger or not charged as close as when the men were fresh at the beginning of the heat. This irregularity in tuyere freedom appears in all long heats.

Test No. 9 was taken next morning by removing all piping from the fan outlet. Here we find 144.6 horse-power required as against 37.2 when the gates were closed after connecting the pipes, a difference of 107.4 horse-power. This shows the great difference required in power between forcing blast into the open air and against bunged tuyeres. Many have supposed that the more the tuyeres were bunged up the greater the power required to drive a fan. The reverse is the case. Test No. 10 is also interesting in showing the greatest blast pressure the fan is capable of producing—when it merely revolves to cut the air. The tests give much that should be of value to all interested in blast production.

It is not to be taken from what has been stated that we wish to advocate the abandoning of the blast pressure gage. It is valuable as a comparative index of the pressure different fans and blowers can create under like conditions. It is also useful to indicate at the commencement of a heat if we are starting off with the pressure that experience with any particular fuel or conditions has proved best for use, and later, at any period of a test what volume of air is being delivered into a cupola, providing we use a speed indicator to observe the revolution of our motors or fans.

I wish to emphasize the importance of such a tool, as by its use we can tell better what volume the fan should deliver into our cupola, providing there were no obstruction. What effect this obstruction has produced, as in the case of bunged tuyeres, we can fairly judge by the pressure gage, and thus be better able to decide whether it is the want of blast or some other factor that prevents our obtaining the expected speed in melting.

This paper would be incomplete if we ignored the relation of blast to different densities of fuel. As a rule, the more dense or solid the fuel the greater volume and pressure required. As an example, 48-hour or soft furnace coke is best blown with one-fourth to one-third less blast than 72-hour, or a solid, hard foundry coke. The evils of blowing any fuel with a stronger blast than is required lie in a destruction of fuel and lining, creation of foaming slag, and early bunging up of the tuyeres.

More depends on using the proper volume and force of blast to suit the different densities of fuel, in aiding successful melting, especially in long heats, than many realize. It is a feature of cupola practice that should be well studied until one finds what is best in his own particular cupola. Full knowledge on these points and watching them carefully at every heat will tend greatly to good melting and full clean bottom drops in cupola practice.

Patent Office Drawings.

BY R. P. KING.

I do not remember having seen anything in these columns about Patent Office drawing, and while this branch of the business is some distance removed from shop drawing, it is still drafting and the shopman may be called upon for this work or he may desire to take up that line. A set of drawings recently came into my office to be made over, having been rejected by the Patent Office; these drawings were the work of a competent man in some lines, but he lacked instruction in this work. It was this incident that suggested this article.

The ideal Patent Office draftsman is the man with the artistic temperament and having considerable mechanical training.

To begin with, there are certain rules laid down in the book, "Rules of Practice," issued by the Patent Office, which book may be had for the asking by addressing the Commissioner of Patents at Washington. These rules furnish us all the information about drawings that is issued by the Office. Anyone contemplating making Patent Office drawings is advised to get a copy of this pamphlet and study the same carefully.

Patent Office drawings are made on a standard Bristol board, "three sheet" being specified. The standard size is 10x15 inches, having a marginal line one inch from the edge, thus enclosing a space 8x13 inches. These sheets may be purchased of standard size and quality, marginal line and all, having the words "Witnesses," "Inventor" and "Attorney" in their respective positions at the bottom of the sheet. The brand I use is the "Strathmore"; my reason for preferring this brand being on account of its superior erasing qualities.

A space of 1¼ inches is reserved at the top of the sheet, and will be filled in at the Patent Office. When beginning a drawing, rule off this reserved portion the first thing and be careful about encroaching thereon, for neglect of this rule will bring a request for a new drawing.

Before beginning on the drawing, size up the device to be illustrated to determine what views will be required to show best the different parts in operation; what scale to make them; and how many sheets will be required. Fig. 1 is usually a view of the whole device, showing its general appearance as an entirety. A per-

spective view will often be most acceptable for Fig. 1, as it introduces the device to the attorney and to the examiner in a manner that appeals to them, for, as a rule, the people the Patent Office draftsman deals with are men not used to reading drawings.

The figures should follow each other in natural sequence, Fig. 1 being at the upper left of the sheet, and Figs. 2, 3, 4, etc., following from left to right and down the sheet. A little thought in this matter will make the work easier for the attorney, besides giving the case the appearance of having been worked over but once. The time-honored "meat chopper" which is set forth as a model in the "Rules of Practice" is about as far out in this respect as it possibly could be. In this connection it might be well to call attention to the fact that a little care in placing the different figures makes a great difference in the looks of the work. Sometimes I have put in an extra figure that was not absolutely needed solely to present a well-balanced appearance.

Patent Office drawings differ from working drawings in several respects. Center lines are omitted, no dimensions are given, stresses are not figured, gear teeth are not accurately drawn, nor is any attention paid to scale in the usual sense of the term. It is often possible to simplify the work by departing from the unessential details of the model device. For instance, it is easier to make the legs of an improved table square instead of turned and ornamented; set-screws are easier to show than keys; a valve may be the merest approximation to an actual valve, and so on.

One thing, however, must not be overlooked: consistency must be preserved throughout the entire set of drawings. Each part must preserve its relative proportion, wherever it appears, whether in the perspective, section, or detail, so as to be easily recognized by whoever comes in contact with the work. This is a very important feature in this work and must never be lost sight of.

Wherever patents are concerned there is liable to be more or less litigation, and the draftsman should always keep in sight the fact that his work may at any time be brought into court and any discrepancies will surely be brought to light by the opposing counsel. An obscure or poorly made drawing will sometimes lose a patent suit.

When planning the different figures, aim to show each part in its position and to show each part but once. One figure may often be used to show a good many parts, thus saving drawing work and the attorney's time.

Patents afford the patentee a monopoly on a novel principle or a combination of principles; and the draftsman must keep this fact in mind, first, last and all the time. The details should be second to the principle, although some attention must be paid to them and the parts proportioned by eye to the work they perform, in order to avoid the grotesque drawings we sometimes see sent out from the Patent Office.

Most attorneys object to the use of dotted lines, and they are indeed very confusing. Sections may be used to show the different parts so that very few dotted lines are necessary. Dotted lines are sometimes used to show different positions taken by parts during some movement, and while such a use is perfectly legitimate, it seems to me that it is far better, except in unusual cases, to insert different figures to show the different positions of a movement.

When drawing gears, chains, etc., draw every tooth or link. These need not be correct from a mechanical point of view, but each one must be shown. The usual way of indicating screw threads applies in Patent Office drawing.

Fig. 1.

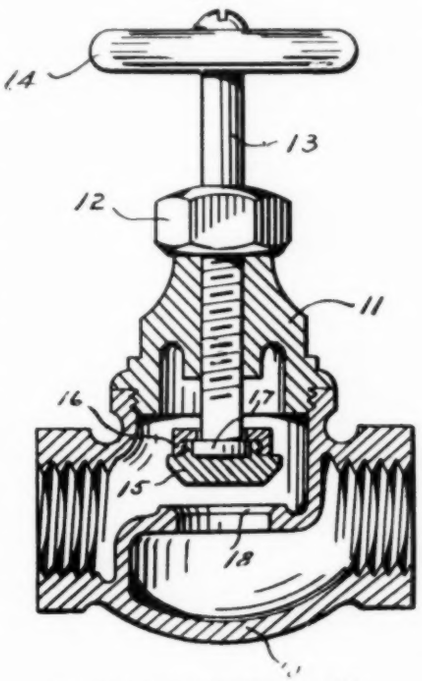


FIG. 1. PATENT OFFICE DRAWING.

After the pencil work is finished, the drawing should be outlined in ink. In this part of the work do not be afraid to use plenty of ink; the more one uses the better the work will look. I shall have more to say of this later; but be sure to get the outline in bold, heavy lines.

The rules require the drawings to be made with India ink; the best to use is the almost universal "Higgins' Water Proof," for an accidental smear with a sweaty hand will ruin a drawing made with common India ink. The drawing must be executed throughout with the drawing instruments as very little free-hand work will be acceptable. This rule is a hardship at first, but one soon becomes used to the drawing pen for shadows, etc., and that method is really the easier.

Outline shading is to be used, darkening the lines on the right and bottom sides as the light is supposed to come from the upper left-hand corner of the sheet.

We are now ready for the shading. With a pencil sketch in the shadows as they may be conceived to fall. The surface shading should take the form of these shadows. Let the surface shading be open, the lines being from 1-16 to 3-32 inch apart, and in wood they may run in the direction of the grain. In order to make up for this wide spacing, make the lines heavy. This accomplishes several ends; the lines do not need to be so accurately spaced; time is saved, for there are fewer lines to be drawn; and, lastly, the reproductions will show up better. When shading convex or concave surfaces, use very heavy lines near the edges, working toward the center always, and let the shading come into the light rather faster than usual, something after the fashion that would be followed when shading an ellipse. This brings the light and shadow nearer together, and shows them both better.

In the back of the "Rules of Practice" is the "draftsman's chart" or plate of conventions. It is far easier and very acceptable to the office to use the plain hatching such as is indicated for wood or metal, for all sections, excepting perhaps liquids and electrical insulations.

The rules say to shade only the round surfaces, but most attorneys require a good deal of surface shading, and it certainly improves a drawing if well done. A few dead-black shadows improve the tone of the work; but use them sparingly, for it is against the rules. A reducing glass is a good thing to use when shading up a drawing for one can tell about the strength of the lines and how the job will look in the *Gazette*.

Reference letters and figures are the last things. For designating the figures use the letter on the plate in the "rules." Reference figures are best rather small, say ⅛ or 5-32 inch high, made plain and open. Connect them with the parts they designate, with a wavy line rather than a straight line, to distinguish it from the lines of the drawings.

Long before this the draftsman has made a "miss lick." Just take a typewriter eraser and rub, not too heavily. If the surface of the paper is badly injured take a hard lead pencil and calender the place before inking again. Never use a scratcher until you are all through drawing, as a touch of a pen on a scratched place ruins the work.

Before sending the drawing away make either a blueprint or a vandyke. Either of these should be negatives. The blueprint takes about 20 minutes in a bright sunlight and the vandyke about 1½ hours. The vandyke has the advantage of being opaque and positive blue-line prints may be had from it at any time.

I attach a little figure that I hope will illustrate something of the above. "One example is better than ten precepts."

Fixtures for Milling a Sewing Machine Arm.

BY H. ROBINSON.

In Fig. 1 are shown several views of a sewing-machine arm of a certain type, which is milled on surfaces indicated by letters *a* to *h*, inclusive. The machining of these places is accomplished in plain milling machines, and as a great many arms are made at a time, four millers are employed for the work, each being rigged up especially for its own work. These machines are placed side by side, enabling the operator to move the arm quickly from one machine to another for the various operations. The different fixtures for holding the arms in the milling machines had to be of a design that would permit them to be readily put on or taken off of any of the four machines, and to so hold the arms that the different surfaces after being machined would be true to each other. Last but not least, the fixtures had to be able to stand a great deal of abuse without getting out of order, must cost as little as possible in the making, and must be designed in no time at all, as the work was wanted in a great hurry.

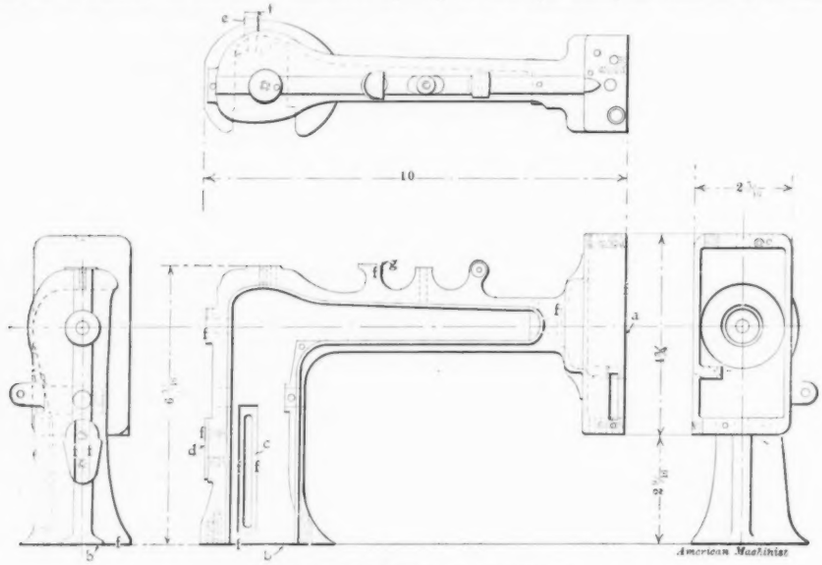


FIG. 1. THE CASTING TO BE MILLED.

Figs. 2, 3, 4 and 5 show the fixtures as designed for this work. The first two answer for one operation each. The third, Fig. 4, is used for two different operations and the fourth for three. In order to have the various machined parts of the arm in line with the rest of the body, as well as the different faces true to each other, the first four operations on the arm are performed in a certain order corresponding to the numbers of the fixture. Thus, Fig. 2 is the fixture for the first operation, Fig. 3 for the second, and so on for the four cuts; then the fixtures Figs. 3 and 5 are reset on the millers in different positions from what they were previously, and the remaining operations completed. All four fixtures are provided with tongues for accurately locating them in position, and provision is made for clamping them fast to the miller platens.

It will be noted that the arm is supported and located in the first fixture, Fig. 2, for the first milling operation, by the screws *i* and *j*. As there are no true faces to go by in this operation, the alinement is made by the main body of the casting, thereby insuring the machining of face *a* square with the rest of the casting. The subsequent operations on the other faces are all performed with the work located from this face. The arm is fastened in the first fixture by pressing it against the stop screws, and tightening screws *k* and *l* which pass through the yoke *m*. The latter is hung on a pin between lugs at the rear, and when swung into place is fastened by the taper plug *n* at the front. Thus the arm is quickly secured and with the end to be machined facing the cutter on the miller spindle.

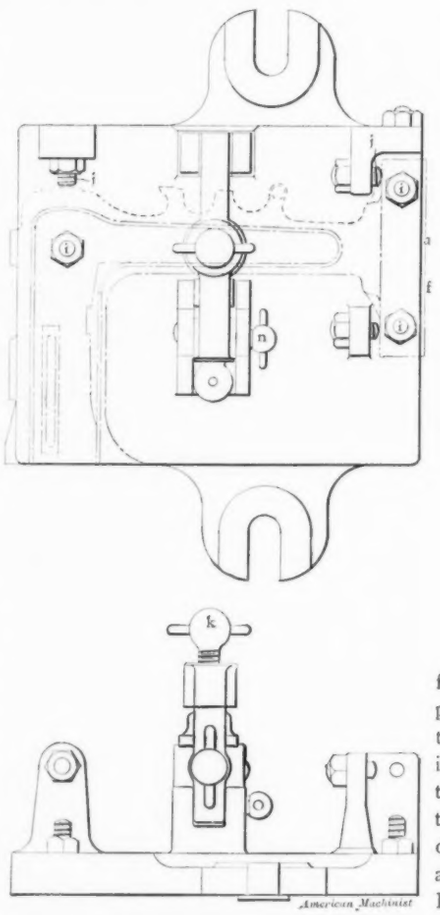
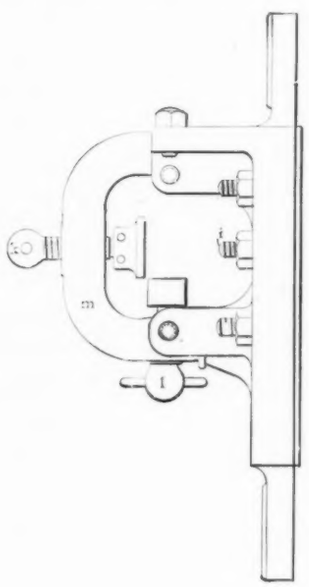


FIG. 2. FIXTURE FOR FIRST OPERATION.

In the next fixture, Fig. 3, where the base *b* is machined, the finished end is drawn up square against a planed surface *o* by a forked clamp. The supporting, stop and clamping screws in the fixture are all clearly shown.

In the fixture Fig. 4, where the slot *c* is milled, another forked clamp is used to draw the arm against finished surface *p*. The screw at the rear forces the machined base against the faced lugs *q*, and an offset clamp holds the work down in place. This fixture, when turned around on the table of the milling machine, brings the face of the top hub *g* into position for finishing.

It will be observed that the fixture in Fig. 5 has two planed resting surfaces and two tongues; hence the arm, when fastened in it, may be set in two different positions before the cutters. When the fixture is bolted down on end *r* the boss *d* is faced: when it is turned over on side *s* the two sides *e f* of the lug at the front of the arm are simultaneously faced by straddle mills. The fixture stands on this base also while the surface *h* (Fig. 1) is milled. It was found more convenient to have the arm drilled before placing in this fixture. The four pins *t* fit easily in the holes drilled in the bottom of the arm, and locate it so that the face *a* comes against the finished surface, as shown. The piece is fastened here by means of the screw and handle at the top.



How Machine Tools are Developed.

BY JOHN RANDOL.

It would seem that the machine tool builders, the men who make tools to sell to men who equip machine shops, would be the very first ones to take up new things as fast as they came to be found useful, and so keep their product as far as possible in advance of common practice. This would appear at first sight to be the sure way to attract customers and keep the name of a tool-building concern in the front rank.

Instead, however, of being continuously progressive, the majority of tool builders are decidedly conservative, and having scored one success as a new firm starting in business with one or more novelties, they display a flinty resistance to any more new things, and by good work and good business methods they succeed in selling their antique creations long after the users could be much better served by well-known forms of thoroughly proved value, which no builder of established reputation cares to meddle with.

It seems, in fact, to be a general rule that the new firm shall begin with some things not before made by any well-known tool builder for general use, and shall never again undertake anything widely differing from the first success.

The result is that every marked advance in machine tool construction is connected with the name of the one tool-building concern which first introduced it, and that when the new tool comes into general use it will be improved and advanced, as the art of metal cutting advances, not by the original builder and introducer, but by a new supplier, who will, in turn, never go very much beyond his original changes. "Let others do the missionary work of enlightening and benefiting the purchaser; we had our hard time of it when we started, and now that customers come to us, and want what we have to sell, why should we cry down our own product and advocate the purchase of something machinists do not demand, simply because it may be proved a good thing ten or fifteen years from now?" That is what the established concern usually says, and makes money by saying it, too. But there is really a steady advance, not more through the efforts of the tool builders than from the demands of the machine shop operators who see the need of better things than are made.

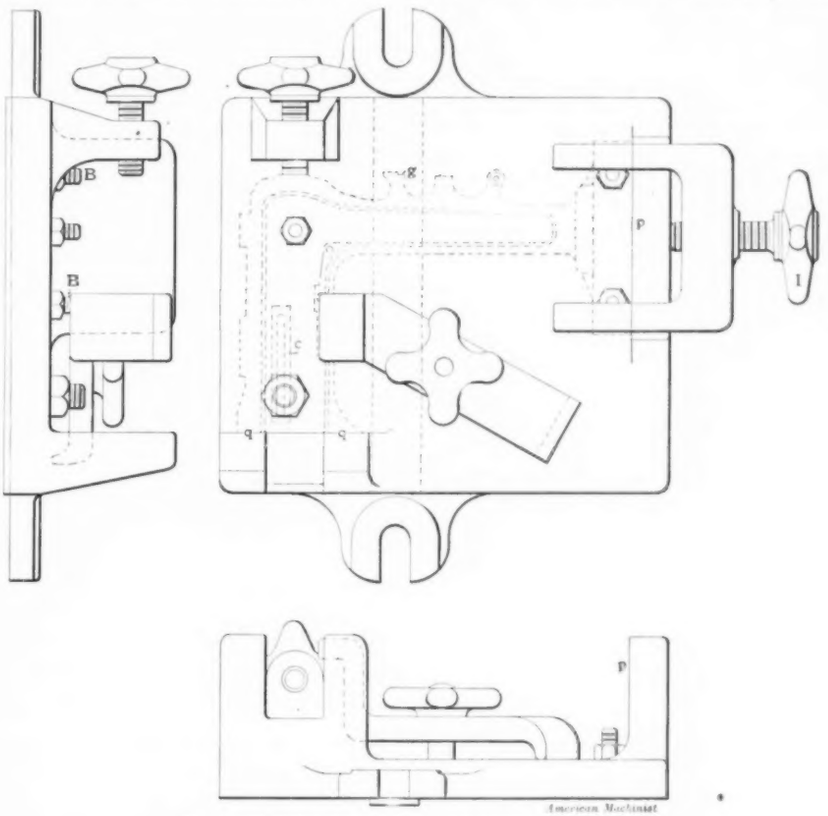


FIG. 4. FIXTURE FOR THIRD AND FIFTH OPERATIONS.

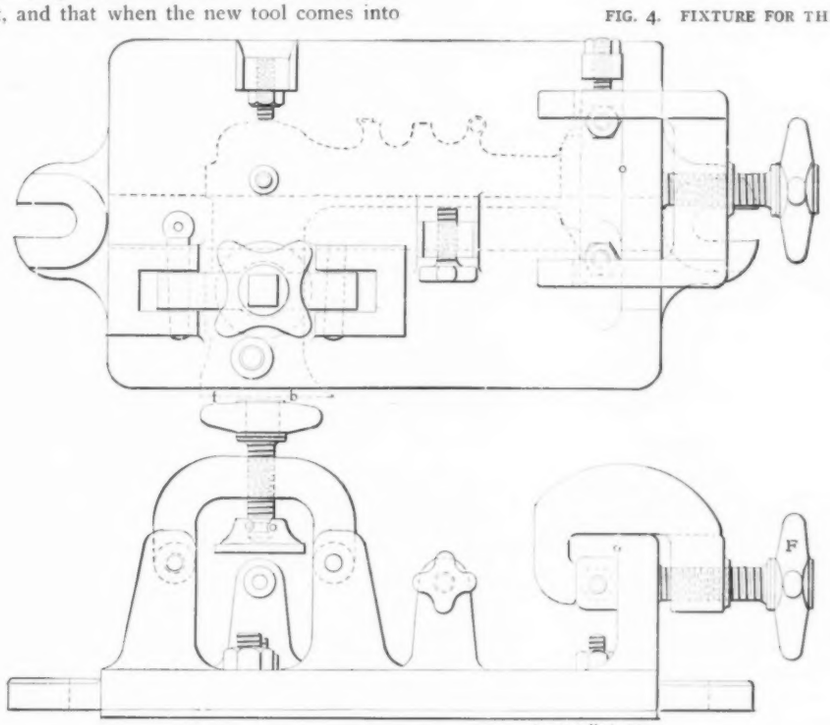


FIG. 3. FIXTURE FOR SECOND OPERATION.

It takes a long time, a very long time indeed, to convince a man who has made a success that he has not reached the final limit. He is commonly so very slow to see better things that he grows old and goes out of business believing the new things that are taking his trade away are all a mistake, and that they have succeeded merely through the accident of lucky combinations of abnormal circumstances.

The fact is that there is to-day just as much demand for improvements and advances in metal-working machines as there was a hundred years ago, and, what is not likely to be very readily admitted, there is just as much probability of cheapening machine production now as there ever was.

In point of fact, there are very great labor-savers in the way of machine tools perfectly well known, fully tested by many years of money-making use, which are now only just barely beginning to be looked upon as possible features of regular machine shop equipment.

Those of us who can look back to the spider-leg headstock, the grass-hopper

saddle and tool carriage, and the skeleton tailstock of the old wooden-sheaved chain-feed engine lathes, and can remember the delighted surprise which welcomed the first all-iron-bed lathes, as built by the Shepard Lathe Company, the Fitchburg Shops, Lathe & Morse, and finally the 14-inch Wood & Light lathe, which was for some years the standard American toolroom machine, will be quite likely to realize the possibilities of the future; much more so than the young machinists who are prone to believe the end has been reached.

When Pratt and Whitney, apt students of the practice of Root, of Colt's Armory, at that time the most advanced of metal-working shops, went together to the Lincoln shop in Hartford and put out the Lincoln tools, they were best. Then Pratt and Whitney started for themselves, and gave the world a second edition of the Lincoln tools in the Pratt & Whitney line of before unknown machines, evolved in Colt's and the Springfield armories, foremost in finding new ways to make small-arms parts, which Pratt & Whitney put into machine-shop sizes, and so greatly changed machine-shop methods at large.

All this time the watch factories were finding out new things, or new and better ways to use old things, and with only two really new elements, the hollow spindle and the draw-back sleeve and collet, built up a whole new system of making small machine parts, which we have just now learned is applicable to quite large diameters in machine production. Long after the watch factories knew the value of the hollow spindle and draw-back collet, Tyler, who came out of a watch factory, put the collet in the Pratt & Whitney 10-inch toolmaker's lathe, which came into favor slowly but surely; and it is only just now that machine-shop managers are beginning to understand that the hollow spindle and draw-back collet give the small manufacturing lathe such increased speed and powers as to make the collet an indispensable feature of modern machine-shop equipment. It has taken thirty years of amazingly successful use in the watch factories to make the machine-shop managers, who perform precisely the same operations on work of larger dimensions, understand the matter so far as to entertain the idea of using these advanced methods themselves.

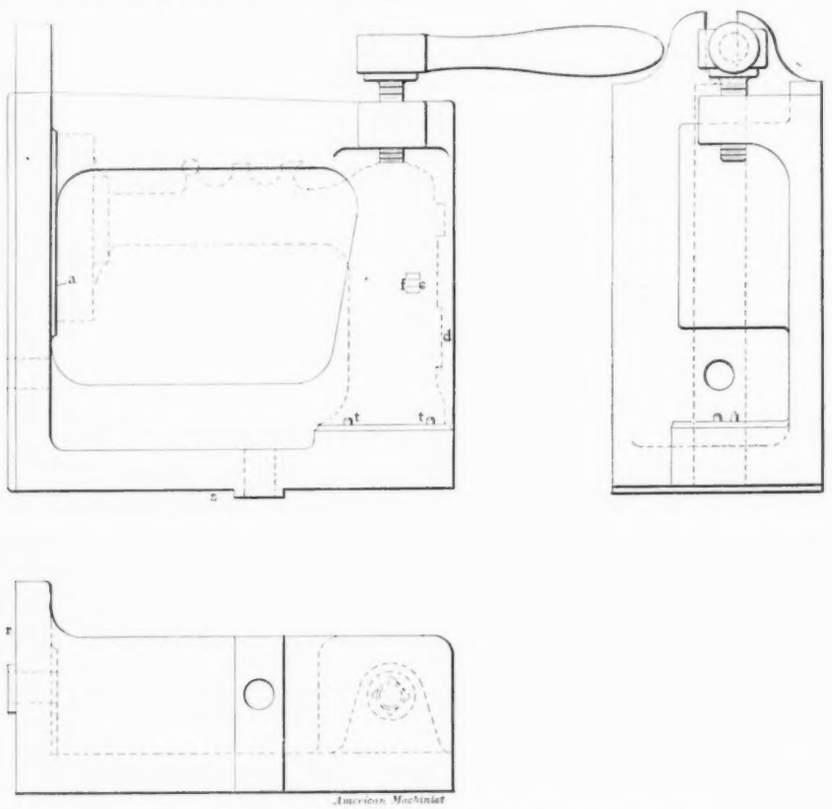


FIG. 5. FIXTURE FOR FOURTH, SIXTH AND SEVENTH OPERATIONS.

Outside of a very few catalogs put out by watch-shop toolmakers there has been little or nothing printed of the details of accurate small tool construction, by means of which lathes, drillers and milling machines, not at all specialized, but of general application up to the limit of their dimensions, can be made to interchange both tools and product in process of finishing, with very great reductions in labor cost.

We have all of us seen large plants, up to date supposedly, in which no two spindle noses and no two spindle centers were precisely alike, and every tool had to have its own equipment, or else special fixtures had to be provided to make one lathe take, say, a chuck first fitted to another lathe.

So long as this condition of affairs is tolerated by unquestioning acceptance, it is not at all surprising that the advantages of having a complete equipment of machine tools up to a certain size, which will interchange parts as well as tools, as the work may require, perfectly, is not fully understood, nor even generally regarded as a possibility, because no approach to such a condition of entire interchangeability has ever been seen outside of the watch shops, and the few managers familiar with the watch-shop methods have not realized that they themselves could use anything of the sort.

Here is a case in point. The Sloan & Chace Company, Newark, N. J., has been well known as a builder of fine small lathes, drillers and gear cutters for the past thirty-two years, having begun almost with the first attempts to produce machine-made watches, and continued ever since with a good reputation, supplying their standard tools and special machines to many of the best known factories, but never showing a balance on the right side of the ledger. The management of the Sloan & Chace company passed a year ago to Charles A. Haney, who retained the former superintendent and designer, Edward C. Osgood, and, after a careful examination of the cost sheets, decided that the failure of this establishment to make money in the past, notwithstanding its wide reputation for the production of well-designed and accurately constructed machines, was due to the neglect of standard repetitions and the great attention given to filling orders for difficult special-tool creations, each one a highly creditable effort, but seldom duplicated, and seldom paying more than fair day wages for the workmen's time. Mr. Haney concluded that the money lay in repetitions of standard product, and resolved to discourage the special-tool end of the business.

Consequently, when the manager of a wealthy and well-equipped machine shop came to Mr. Haney with the request for a special tool to produce duplicates of a model exhibited, which could well be made on the regular Sloan & Chace No. 5 lathe, he said to the manager, "You do not want a special tool for this job. You want our regular No. 5 lathe. A special tool will make in one month all the pieces you can use in a year, and must stand still and take up shop room for no return the other eleven months of the twelve. You put in our regular lathe, and it will do this job as well as a special tool, and your men can make use of it for other purposes when not working on this piece."

"But," replied the manager, "we do not use anything so light as your No. 5 lathe; we have no work suitable for it."

"You put in this lathe that I recommend," said Mr. Haney, "and see whether your men can find use for it. You will find when you have it in the shop that it will never be idle a minute."

The customer was doubtful, but con-

sulted his superintendent, and finally the regular No. 5 lathe was installed, and was in such constant demand that two more are expected to be soon ordered, and Mr. Haney says this same shop needs at least six of these small lathes, for which the manager, who is well informed in regard to sizes of tools he is familiar with, thought the shop could find no work.

The truth is that most men find no fault with the bridge that carries them safely over, and when they once have tools which will produce work at a profit, it is very hard to convince them that any change could be advantageous, especially in the way of installing high-priced plant of a class never before used by them, and they really feel as if it was absurd to think of paying more for a little tool a man can carry under his arm than the price asked for a pretty good engine lathe of medium size.

It is certainly as difficult as it is unusual for a manager to see good reasons for changing a profitable policy, but, in point of fact, so many conditions of occasion and environment enter into every commercial success, small or great as may be, that no single money-making example can be safely held as establishing a rule, and it is not at all certain that what is best at one time may not be rank folly on another day and occasion.

The erection of a heavy steel frame building in this city involves the transportation of some heavy pieces for long distances through the streets. A number of plate girders 50 feet long and 10 feet deep have recently been trucked a distance of two miles, requiring a team of twenty-one horses. A hydraulic jack was carried along to assist in starting the load when a stoppage occurred. One of the daily papers gave the dimensions of one of the girders as 150 feet long and 32 feet wide.

The following is from the annual record of target practice of the Asiatic fleet as reported by Rear Admiral Evans: In 11 minutes and 20 seconds the best 13-inch gun of the "Wisconsin" made 9 hits, the "Oregon" 6 hits, and the "Kentucky" 5 hits. The best 5-inch gun of the "Kentucky" made 11 hits in 2 minutes.

Calculations for Hydraulic Punching and Shearing Machine.

BY ARTHUR H. JACKSON.

I have read with much interest Mr. Raeburn's letter at page 128, on the subject of Mr. Herzberg's calculations of the strength of the main frame castings for the above-named machine.

At the time the original articles appeared I felt strongly moved to write to you myself on the subject, but was too busy at the time. After reading Mr. Raeburn's able letter I feel that I should like to add a few remarks to clear up some points which seem to me to be still somewhat obscure.

In the first place I would point out that Mr. Raeburn assumes as correct Mr. Herzberg's figures for the pressure required to shear the plate, and for the distance from the point of application of that pressure to the back of the throat of the machine.

In calculating the pressure required to shear the plate, Mr. Herzberg apparently takes the area under shear at any time to be the whole trianguar area of the plate between the shear blades. This is surely incorrect. I have always understood that a plate offers no further resistance to shearing after one-third of the thickness has been severed. This is borne out by the diagrams and statements in Messrs. Sellers' letter at page 886, Vol. 22.

The accompanying diagram, Fig. 1, illustrates how I am accustomed to estimate the area under shear. It will be seen that the line drawn at one-third of the thickness, or .458 inch from the top of the plate, intersects the line of the upper shear at a point 2.576 inches from the point where the upper shear first touches the plate. This length, multiplied by the thickness of the plate, gives the area to be taken and the pressure required is.

$2.576'' \times 1.375'' \times 57,200 = 202,600$ pounds.

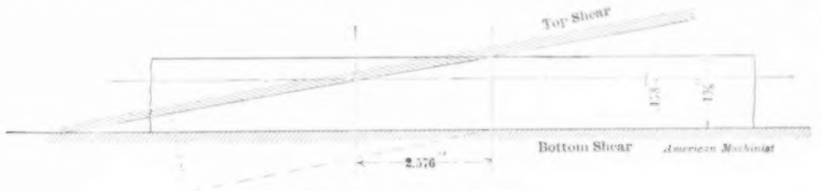


FIG. 1. AREA UNDER SHEAR.

Then in calculating the moment of this pressure Mr. Herzberg has assumed the point of application to be in the line of the center of the hydraulic piston. Surely this is incorrect. The pressure will be transmitted from the piston to the shear blades in a diagonal line, but that cannot alter the fact that the pressure is between the shear blades themselves, which are 29 5-16 inches from the back of the throat.

Then, as the punching pressure is admittedly the greater, and the depth of throat at that side is given as 29 5-16 inches, why was not the calculation made for the punching side?

I should like while I am about it to point out an error in Mr. Herzberg's use of Sellers' empirical formula, which is apparently taken from their letter referred to above at page 888, Vol. 22.

The formula $W = 14,000\, d\, t^2$ is for work done in foot-pounds, which is not to be confounded with pressure required. Messrs. Sellers state that it is their custom to assume that the pressure required in punching is equal to the *tensile* strength of the material, multiplied by the area of the section cut through in punching. This agrees entirely with our own practice. The shearing strength of the steel to be punched in this case is given as 54,000 pounds per square inch. The tensile strength of such steel should not be taken less than 65,000 per square inch. The pressure required to punch would thus be:

$1.5625 \times \pi \times 1.3125 \times 65,000 = 418,773$ pounds.

As regards the strength of the cast-iron frames I feel sure that it will be of service to some to see how such a problem may be worked out without the use of abstruse Greek letters and other signs. The only formulas I use are, that for the moment of inertia of a rectangle about its base

$$I = \frac{b\, h^3}{3}$$

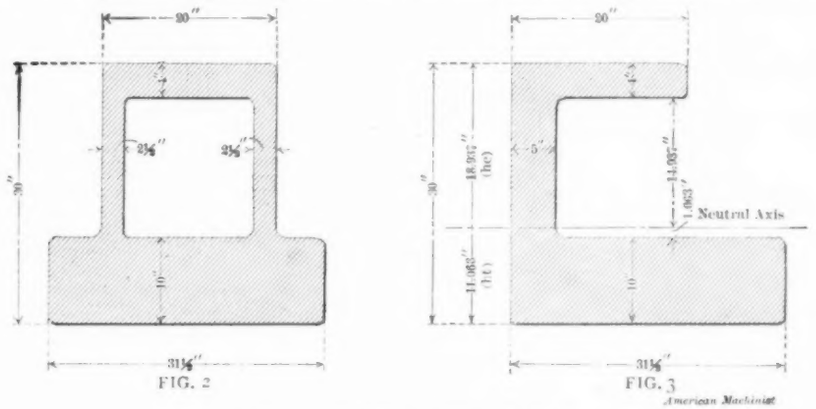
and

$$f = \frac{M\, h}{I}$$

M being the bending moment, f the maximum stress per square inch, and b and h the breadth and hight of a rectangular section, respectively.

Fig. 2 shows the section of the frame at the back of the threoat, and Fig. 3 the equivalent of this section in a form more convenient for purposes of calculation.

To obtain the position of the neutral axis (which is at the center of gravity of the section) I take each area and multiply it by the distance of its center of gravity from the base line. The sum of these



ACTUAL AND EQUIVALENT SECTIONS.

products, divided by the whole area of the section, gives the distance from the neutral axis to the base line, thus:

10″×31.5″=315 sq. in.		315× 5=1575
5″×16″ = 80	"	80×18=1440
20″× 4″ = 80	"	80×28=2240
Total area =475 sq. in.		Total products=5255

$$\frac{5255}{475} = 11.063''$$ from base line to neutral axis.

Then, filling in the dimensions in Fig. 4, I state the equation for the moment of inertia I as follows:

$$I = \frac{[(31.5 \times 11.063^3) + (20 \times 18.937^3)] - [(26.5 \times 1.063^3) + (15 \times 14.937^3)]}{3}$$

$$= 42,816.$$

It will be noticed that the moments of inertia of two enclosing areas are taken first above and below the neutral axis, and that the moments of inertia of the spaces are afterwards deducted.

The pressure required to punch is 418,773 pounds. The depth of throat from

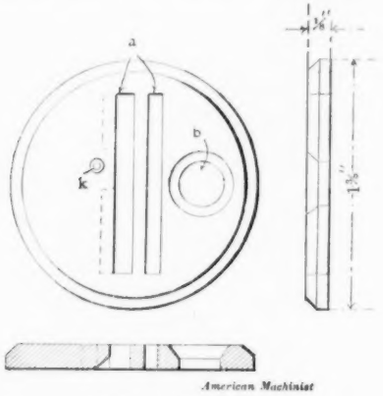


FIG. 1. THE WORK.

center of punch is given as 29 5-16 inches (figured on drawing 29⅝ inches). The bending moment M is:

$$M = 418,773 \times (29.3125 + 11.063)$$
$$= 16,908,169 \text{ inch-pounds.}$$

Then f_1, the stress in the outer fibers of the tension flange is:

$$f_1 = \frac{16,908,169 \times 11.063}{42,816} = 4,369 \text{ pounds}$$

per square inch due to bending. To this must be added $\frac{418,773}{475}$, or 882 pounds per square inch due to the equally distributed tension, giving a total tensile stress of 5,251 pounds per square inch.

$$\text{Similarly } f_c = \frac{16,908,169 \times 18.79}{42,816}$$
$$= 7,478 \text{ pounds per sq. in.,}$$

due to bending. Deducting in this case the 8,821 pounds per square inch due to tension we get the total compressive stress as 6,596 pounds per square inch.

For the shearing side of the machine the tensile stress works out at 2,540 pounds per square inch and the compressive stress at 3,191 pounds per square inch. These figures are rather misleading. The actual stresses are considerably more at the beginning and end of a long cut when the stress becomes greatly intensified at one or other of the two corners. This point may perhaps be made clearer if we compare the machine with a gate shear, the two frames of which are each made strong enough to take all, or nearly all, the pressure of the cut. At the commencement of the cut nearly all the pressure comes on the left-hand standard and at the end of the cut it is nearly all on the right-hand standard, while at the middle of the cut the pressure is about equally divided between the two standards.

If we take into account the 2-inch bolts connecting the two frames together, taking moments about the top of the joint between the frames and straining the bolts at 15,000 pounds per square inch, we find that the four bolts would resist a pressure at the punch of about 56,000 pounds, or about 13.4 per cent. of whole pressure. This assumes that all the bolts are screwed up equally and quite tight. It is difficult to imagine that they were not put there with some such intention, but it would be much better not to depend on them at all.

The section of the frame as given does not include the outside ribs at the back. The omission of these is partly balanced by the vertical recess which is apparently planed down the middle of the flange at the back. Then the section gives the width over webs as 20 inches, whereas the drawing shows 19¾ inches. These are minor differences which do not greatly affect the result.

Manchester, England.

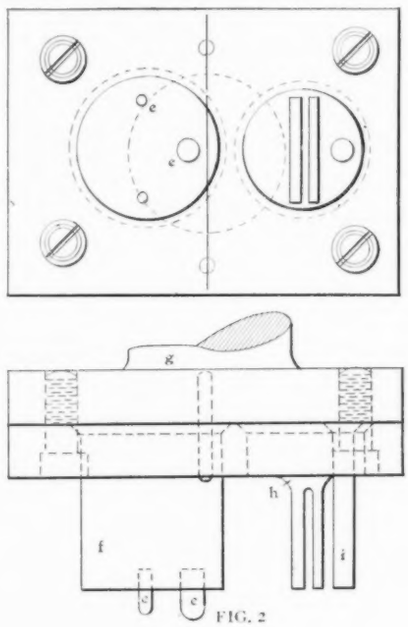


FIG. 2

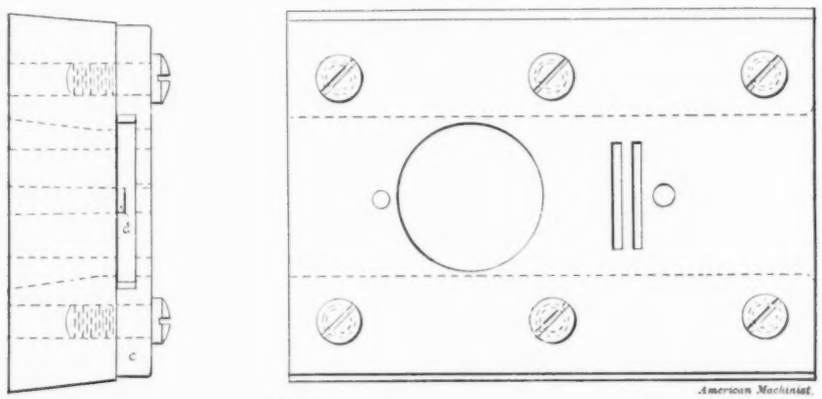


FIG. 3

THE PRESS TOOLS.

Making a Sewing Machine Needle Plate.

BY H. ROBINSON.

In Fig. 1 is shown a round plate, made of cold-rolled steel, and used as a needle plate in a certain type of sewing machine. Figs. 2 and 3 show the gang punch and die for punching out the plate and forming the two slots *a* and round hole *b* at one stroke of the press. As the stock is fed under stripper *c* the three holes are punched, and when the strip is moved along till it comes up against the stop-pin *d* the circular plate is punched out, the three pins *e* which enter slots *a* and hole *b*, locating the stock in the proper position under punch *f*.

In order to insure durability in the cut-

ting edges of the die and the retention of its size, approximately, after grinding, the clearance does not exceed .0015 inch for a depth of ⅜ inch from the top, but is necessarily more at the bottom, to facilitate the dropping out of the blank. To the punch is attached with screws a flat piece of steel in which are fitted snugly the upper ends of *f* and *h*. The punch *i* is fitted in the round shank of *h*. The flanges on the shanks of the punches keep them from pulling out.

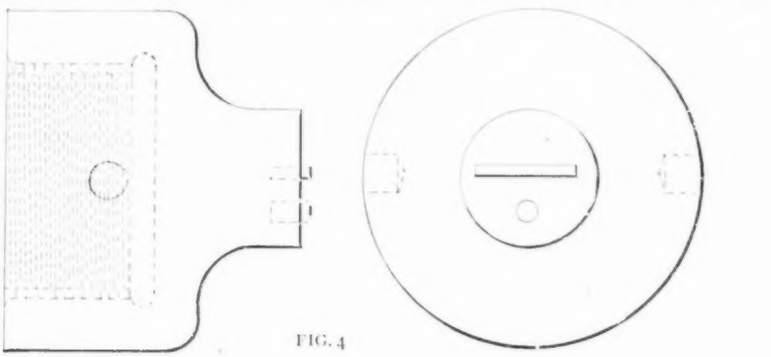


FIG. 4

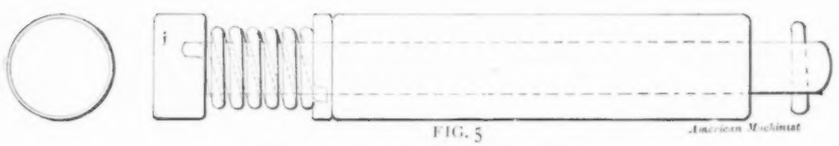


FIG. 5

TOOLS USED IN SHAVING OPERATION.

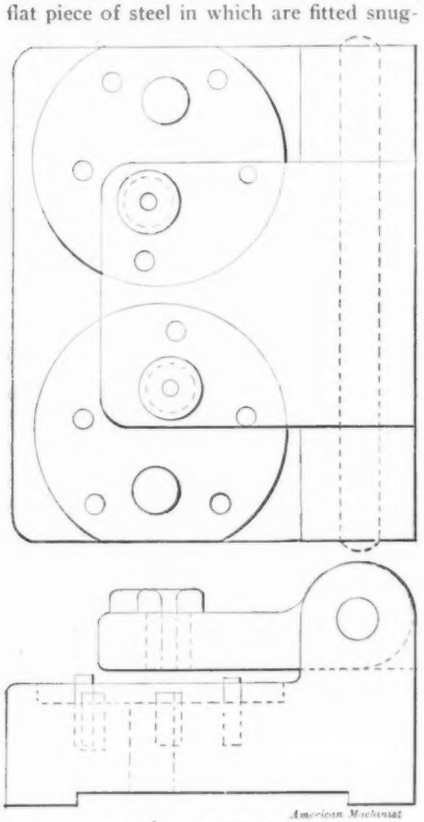


FIG. 6. THE DRILL JIG.

Figs 4 and 5 show the tools employed for shaving and chamfering the outer edge of the needle plate after it is punched out in the die. This work is done in a hand screw machine, the threaded end of the chuck, Fig. 4, fitting the spindle nose, and the plate fitting nicely over the projections in the chuck face, which act as drivers and are so situated as to bring the needle plate central. To prevent the plate from coming off the chuck while being turned, the revolving spring plug, Fig. 5, is fastened in the turret, and the end *j* brought up against the piece. The spring keeps the work in place; and *j* of course runs in its sleeve when brought into contact with the disk. A forming tool finishes the edge, making it smooth and to correct size.

The small hole *k*, Fig. 1, for certain reasons is not punched, but is drilled in a jig, Fig 6, this forming the third operation. Two needle plates are held at one time in the jig, there being, as shown, two circular recesses to receive the work. The plates rest on the tops of three pins, so as to insure their lying level, and two pins fit in one of the slots in each plate and locate it. The two drill bushings are carried in the "flap."

It will be noticed in Fig. 1 that the side of one of the slots in the needle plate is beveled at the bottom; that bevel is milled out in a profiling machine while the plate is held in the fixture shown in Fig. 7. This fixture, which is bolted to the profiler table, has at *l* a recess for holding the plate at the required angle; there are also projections in the recess for correctly locating the plate. The slot

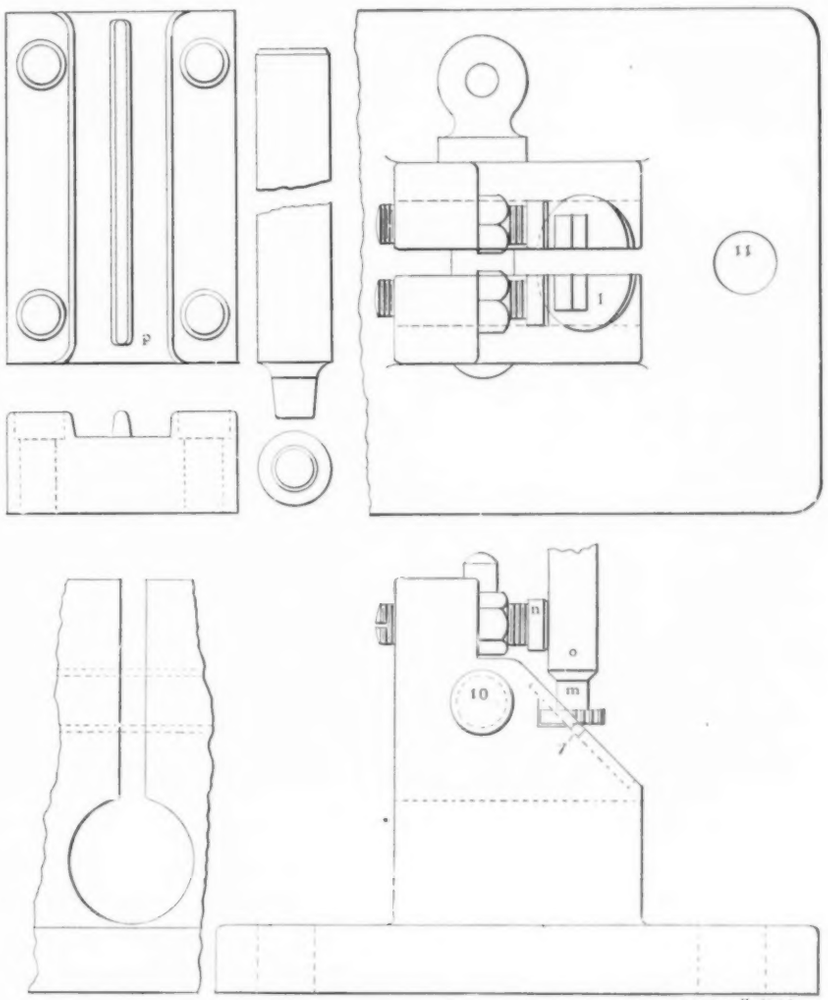


FIG. 7. PROFILER FIXTURE.

in the center of the fixture and the large hole near the bottom make it possible to clamp the work by slightly turning the binding screw, as the plate fits in its seat nicely. The milling is done by the cutter *m* fastened in the profiler spindle; the shank of the mill comes up against the two stops *n*, and thus the stock is cut out nicely, leaving only a very small corner to be filed out by hand. The milling cutter is guided to its place in this operation by a pin *o* fastened in the socket in the profiler head and moving in a guide-block *p* which is secured to the table of the machine. This operation completes the machine work on the piece, which is now ready for polishing and nickel plating.

The commencement of the Williamson Free School of Mechanical Trades, of Philadelphia, will take place March 26.

The Electric Motor in Wood-Working Factories

We have shown many illustrations of electrically driven machine tools, but few or none of similar applications of motors to wood-working machinery, and the accompanying half-tones from the newly completed factory of the Baltimore Sash & Door Company (which escaped destruction during the recent fire) will interest our readers.

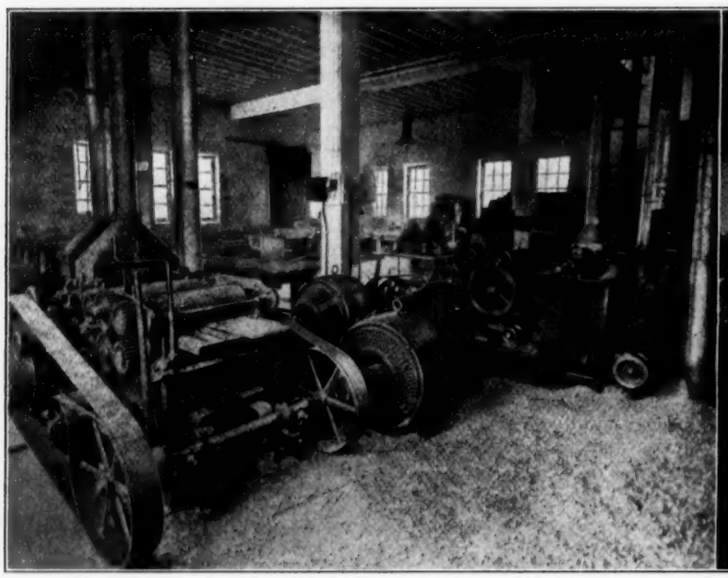


FIG. 1. MOLDER AND PANEL RAISER WITH DIRECT-CONNECTED MOTOR.

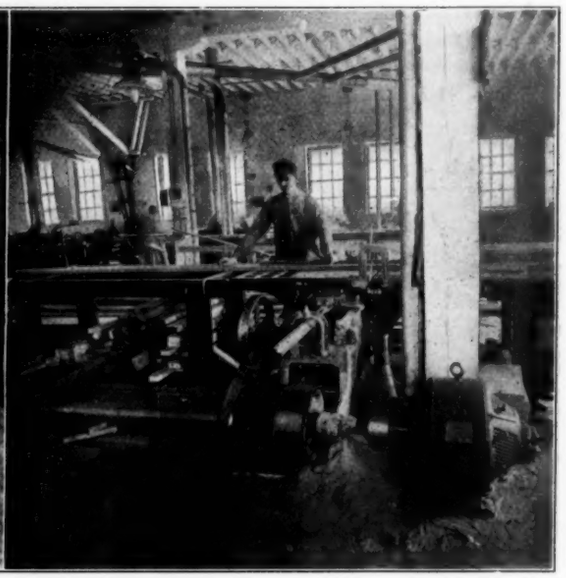


FIG. 2. CUT-OFF SAW WITH DIRECT-CONNECTED MOTOR.

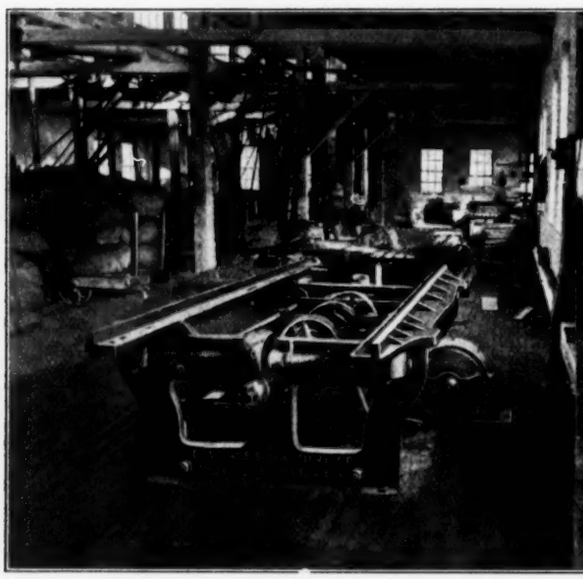


FIG. 3. DOOR CLAMP WITH DIRECT-CONNECTED MOTOR.

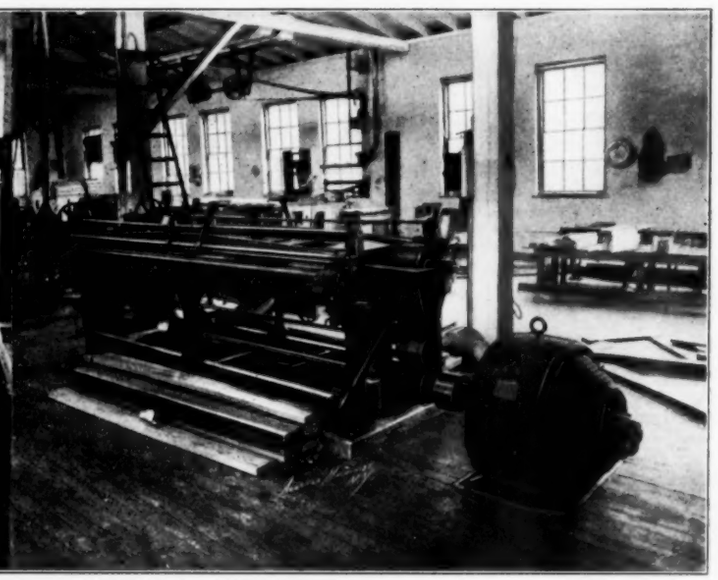


FIG. 4. 8-SPINDLE RAIL BORER WITH DIRECT-CONNECTED MOTOR.

As in the case of machine tool driving, both the individual motor and the group systems are used, though our illustrations relate chiefly to the former. The mill is a large one with a capacity of 500 doors and 600 sashes per day of ten hours, or approximately 150,000 doors and 180,000 sashes per annum. Many of the machines are fitted with hoods and exhaust pipes, some of which appear in the illustrations, for collecting the shavings and sawdust and conveying them to a storage bin over the boiler-house, from which they are led by automatic feed pipes to the furnaces. They supply all the fuel needed at the mere cost of collection and conveyance. The pipe system is operated by a 55-inch Sturtevant blower and a 42 horse-power motor. The motors used are all of the Westinghouse type "S" semi-enclosed pattern, the larger sizes being generally compound wound, while the smaller ones are shunt wound.

The illustrations are self-explanatory and do not need extended explanation. The following is a list of the leading machine equipment, of which the memoranda regarding the sizes of the motors used will be found useful to those engaged in installing similar work. Six months' work has shown the sufficiency of the motors for their duty:

Sixteen-inch cut-off saw, 4,000 feet per minute, made by J. A. Fay & Co., with 3½ horse-power, 700 revolutions per minute, motor.

End paneller, made by E. B. Hays Machine Company, with 3½ horse-power, 700 revolutions per minute, motor.

Panel raiser, capacity 600 panels per day, made by E. B. Hays Machine Company, with 15 horse-power, 600 revolutions per minute, motor.

Fourteen-inch molder, made by J. A. Fay & Co., with 15 horse-power, 900 revolutions per minute, motor.

Nine-inch molder, made by J. A. Fay & Co., with 10 horse-power, 1,000 revolutions per minute, motor.

No. 4 American 40-inch band resaw, with 10 horse-power, 630 revolutions per minute, motor.

American double surfacer, with 7 horse-power, 900 revolutions per minute, motor.

Forty-two-inch band resaw, with 10 horse-power, 600 revolutions per minute, motor.

Sixteen-inch swing saw, with 3½ horse-power, 1,600 revolutions per minute, motor.

Vertical shaft variety molder, 3,000 revolutions per minute, made by J. A. Fay & Co., with 2 horse-power, 1,200 revolutions per minute, motor.

Forty-two-inch sander, made by J. A. Fay & Co., with 15 horse-power, 650 revolutions per minute, motor.

Scroll saw, with 2 horse-power, 1,200 revolutions per minute, motor.

Eight-drill rail borer, made by E. B. Hays Machine Company, capacity 600 rails per day, with 6 horse-power, 700 revolutions per minute, motor.

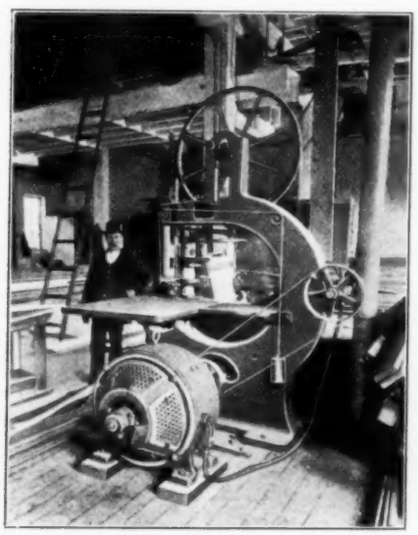


FIG. 5. 40-INCH BANDSAW WITH DIRECT-CONNECTED MOTOR.

Door clamp, made by E. B. Hays Machine Company, one door per minute, with 3½ horse-power, 1,120 revolutions per minute, motor.

Dowel driver, made by E. B. Hays Machine Company, with 3½ horse-power, 700 revolutions per minute, motor.

Double-end tenoning machine, made by E. B. Hays Machine Company, with 15 horse-power, 1,100 revolutions per minute, motor.

Twenty-eight-inch drill stile borer, made by E. B. Hays Machine Company,

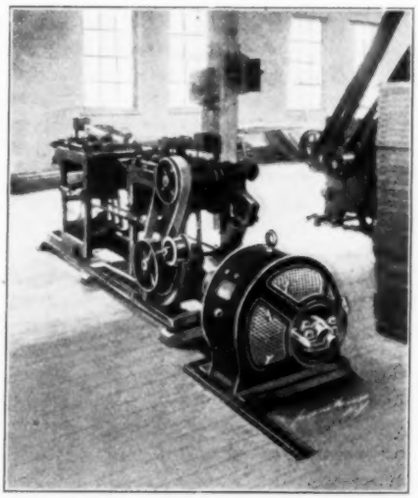


FIG. 6. STILE BORER WITH DIRECT-CONNECTED MOTOR.

with 10 horse-power, 630 revolutions per minute, motor. This machine will in one day turn out material for 1,200 doors.

On the first floor a 3½ horse-power motor operates a small group of emery wheels and saw files in the repair shop. In the sash department 10 horse-power and 15 horse-power motors, respectively, operate two short line shafts, to one of which is belted two American sash stickers, one hollow chisel, one franking machine, one buzz planer and one gang rip saw, while the other drives a 6-inch, four-sided molder, one combination saw, one single-end tenoning machine, one American sash dovetailer, one chain mortiser, one pony planer and one emery grinder.

Sending Things to the Editor.

The "Topics of the Times" man who writes under that head for *The New York Times*, after discussing the other day a certain mystery, treats of another one in a manner that is sure to appeal to most editors and may be profitably read by many who contribute to this or other journals.

Another mystery, he says, much greater than that just discussed, and one upon which, we frankly confess, we couldn't cast even the faintest gleam of light though we tried to do so ever so hard, is why people with something which, for good reasons or bad, they particularly desire should be "put in the paper"—this paper or any other—so often set about the attainment of their desire in the very way that renders that attainment either unnecessarily difficult or actually impossible. This strangely popular way is to send or carry their news item, or whatever it may be, not to the paper, but to somebody on its staff with whom they happen to be personally acquainted, with an expression or an intimation that he or she will do the sender or bringer of the item a highly appreciated favor by printing it. With a solemnity that is also entirely and sincerely in the interest of a public every member of which now and then has need of the publicity that newspapers can give, we want to announce that this method is utterly wrong—that, in ninety-nine cases out of hundred, instead of increasing, it decreases the chances for the publication of any news or notice except those that obviously ought not to be published at all. In the latter case "pull" might possibly accomplish on some papers what nothing else would, but if the matter to be submitted is either harmless or desirable from the standpoint of ordinarily honest journalism, it will reach the office under the very best possible auspices if it comes on its merits, addressed, not to an individual, but to a position. "The Editor" is always right, and "The Managing Editor," or "The City Editor," cannot be seriously wrong, as a direction, written or spoken. That the other plan makes needless and useless trouble for the chosen intermediary is the least of its demerits, and one to which the man with an axe, good, bad or indifferent, to grind can ascribe weight or not, as he pleases; but what he should remember for his own sake is that the members of a newspaper staff do not "put things in the paper" as a favor to each other or to each other's friends, and that anything which comes to the decisive desk

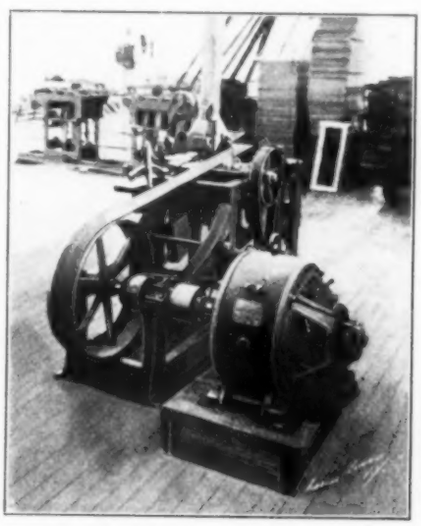


FIG. 7. SASH STIEKER WITH DIRECT-CONNECTED MOTOR.

for that particular thing through other than the strictly regular channels is for that very reason subjected to a much severer judgment than it would receive were it allowed to speak for itself. In revealing these secrets of the journalistic prison house our course is in violation of custom and tradition, but the public can

profit much from the revelation if it only will. It can also save a frightful wear and tear on journalistic tempers, and while that's not much, it's something.

A Taper Boring Bar—Sawing Crankshafts—An Indicating Micrometer.

BY AMOS PRICE.

It was the Club's intention to discuss the more important parts of steam engines

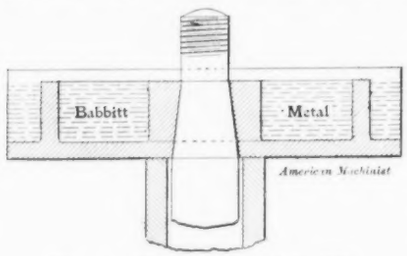


FIG. 1. REMOVING SHRINK FITS.

during the winter months, to be followed by the subject of superheated steam, but the continued illness of the secretary, who had the program of speakers and topics partly arranged, left us without an order of business for several meetings.

A member who had brought his copy of the AMERICAN MACHINIST No. 5 remarked that the "Special Lift" shown at page 137 had interested him very much, as he was scheming to handle his output by similar methods, and thus secure some of the advantages of substituting mechanical energy for human labor. He sketched the illustration accompanying the article in question on the blackboard, saying that in his case it seemed better to have stationary hooks, and a single trolley with a lever to lift the work on the hooks. A brief discussion of liquid controlled air hoists followed the description, when the president remarked that the value of the special lift to most of us consisted in showing what an up-to-date man can do with a back-number plant. Then he asked the AMERICAN MACHINIST man what else he found in his paper that would be of interest to the club.

The plan for removing shrink fits shown at page 139 was then sketched on the board, and extracts were read from the article accompanying it. It was remarked that pistons are not usually solid disks, as shown in the sketch, but are of the box and spider types. In case the latter kind is to be taken off, the piston should be supported on end, as in Fig. 1, as close to the rod as possible. Then put a sheet-iron casing around the outside, putty up the cracks with fireclay, and fill all the cavities with very hot lead or babbitt metal; then strike the end of the piston rod, to drive it out, as hard as it is safe. If the piston head is of the box form, take out the core-hole plugs and pour the metal in, taking care that the head is dry, to prevent the melted metal from blowing. Of course a hydraulic press is the thing to part this kind of work with, where it will be found, that from 2,000 to 5,000 pounds pressure on the end of the rod will be required for each inch of area of the fit to be parted.

The boring bar for taper holes, shown at page 145, was then shown, and met with nothing but adverse criticism. It was not clear how the amount worn and ground off the tool was compensated for, nor how the bar could be supported, and it was contended that the wedge would soon get worn full of offsets, making the hole bored of an irregular taper, and that it was neither safe nor mechanical to have a tool slide in its slot while working.

A member who had heretofore taken no part in the meetings stated that he was using bars that would bore straight or taper holes, and that they were adapted for face-plate work or for work bolted to the carriage of the lathe. He sketched his bars on the board, and I copy his sketches in Figs. 2, 3, 4 and 5 as nearly as I can remember. For boring work on the face-plate the rig is shown in Figs. 2 and 3, and consists of a plain bar with a sleeve *a*, one end of which is slotted and set-screwed for the tools, while the other is fastened to a holder *b*, which keeps it from revolving with the work, and feeds it by being supported at *c* against the tool-

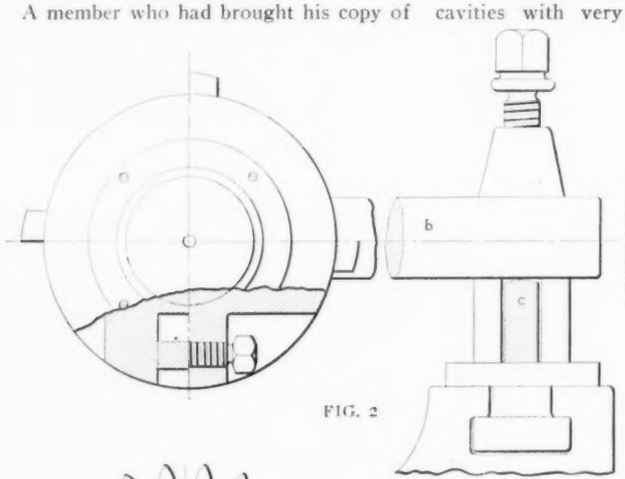


FIG. 2

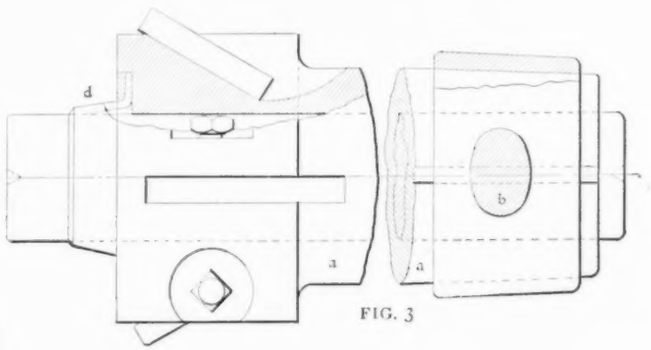


FIG. 3

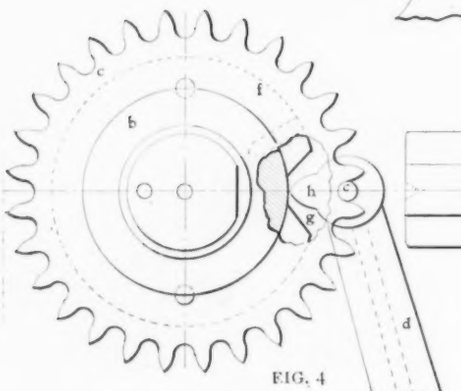


FIG. 4

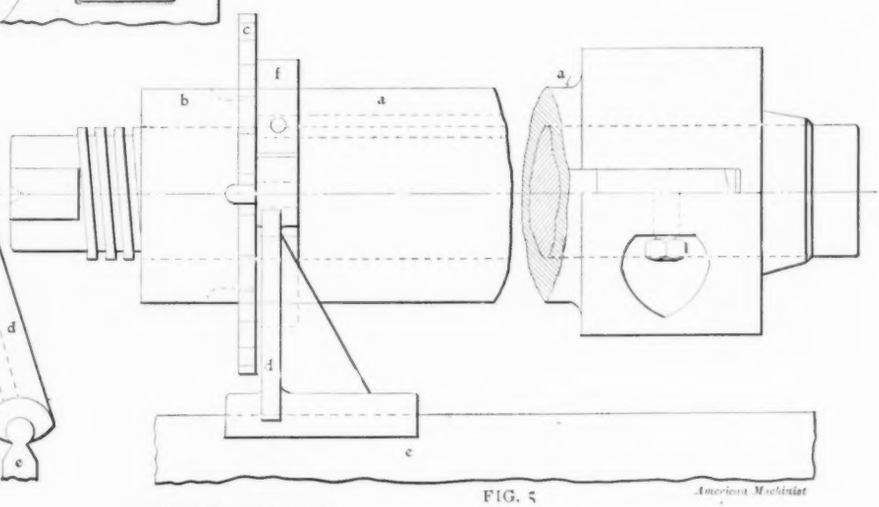


FIG. 5

American Machinist

TAPER BORING BARS.

post. Any number of tools may be used in boring straight holes. For tapers the tail center is set over, and two tools are used. After roughing with one, the holder is loosened and the sleeve is turned half over, thus bringing the finishing tool in position. The tools of course are set so their cutting edges will be at the same hight as the lathe centers. A leather cup *d* prevents the chips and dust from working in between the sleeve and bar.

For boring carriage work the rig, shown in Figs. 4 and 5, is somewhat more complicated. Here we have the same sleeve *a* with its tool head at the right, the sleeve being splined to slide in the bar. The left-hand end of the bar is threaded and a nut *b* carries a star feed wheel *c*, which is operated by the pin *c* of the pawl *d*, which is supported by and slides upon the strip *e* bolted to the lathe carriage. The left-hand end of the sleeve *a* carries a cam *f* having a notch *g*. At each revolution of the bar the finger *h* of the pawl *d* drops into notch *g*, thus engaging a tooth of the star wheel and turning the wheel until the turning of the cam again lifts the pawl out of engagement with the star wheel. For taper holes one end of the bar is set over by an eccentric center, as shown in Fig. 4. The objection to turning or boring taper work on offset centers may be obviated by using ball centers.

An invitation by the president of the club, for more shop appliances, was responded to by a member sketching a "sawmill," as he called it, and an indicating micrometer. He said that his people wanted crankshafts for twin cylinder gas engines a year or so ago, and could not get forgings fast enough. There was no scarcity of steel slabs, however, and he had them cut to length, laid off and drilled, then sawed to the dotted lines of Fig. 9, on the shaper, as shown in Fig. 6, and without to any great extent interfering with the regular shaper work. The "mill" is shown while sawing edgewise through the slab to form the crank, the slab being set on end when the shaft is sawed out. The saw frame is guided in a slotted piece, bolted to the end of the shaper ram, allowing the saw enough vertical movement to cut out the crank. When sawing out the shaft, another saw frame is used, having a quarter twist, to permit the yoke to clear the slab. No further explanation is needed, except to say that in sawing endwise of the slab, two or more "hitches" were necessary, owing to the "angularity of the connecting rod" to the saw frame.

Fig. 7 shows how he fastened his counterweights to the shaft. He said that the weights were secure and could be placed on the shaft after it was in the crank case, which was important, as it permitted the end holes in the case to be made much smaller, and thus giving a stronger frame. A dowel pin is inserted at *a*.

He had noticed that lathesmen lost considerable time in adjusting micrometers to find how much metal remained to be taken off. He considered an indicating micrometer advantageous, and had made one from an old instrument by splitting the frame and inserting a lever *a*, Fig. 8, pivoted as close to the bottom as possible. The fulcrum pin was made eccentric to take up wear, and has a nut on the lower side. The long end of the lever was chisel-pointed, and swept the outside of the frame from *b* to *c* the edge of the frame being graduated at this point to read in thousandths, the ratio of the movement of the lever ends being 1 to 10. A button *d* is screwed into one side of the frame, just touching the lever, and a slight pinch on it holds the lever. To illustrate the use of the instrument, suppose we are turning a shaft, to be finished 3 inches. We set the instrument to that diameter with the lever back to the zero line, a position to which the spring *e* always brings it when free to act, then, without stopping the work, we press the button *d* just hard enough to overcome the resistance of the spring, so it cannot bring the lever back to zero, and push

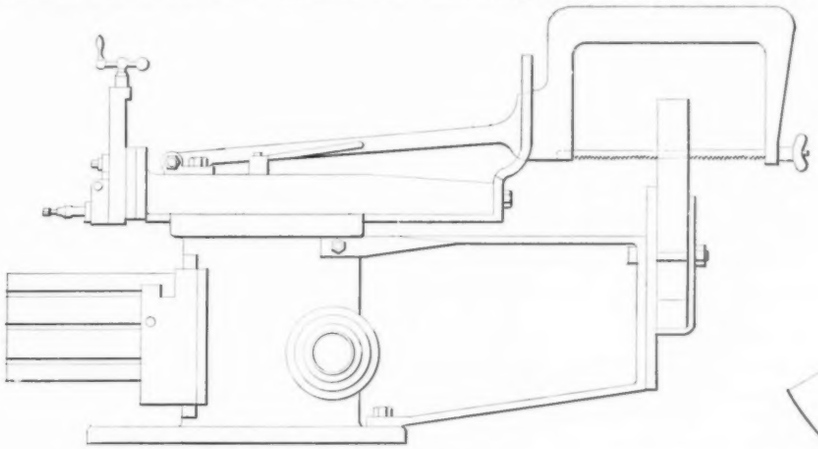


FIG. 6

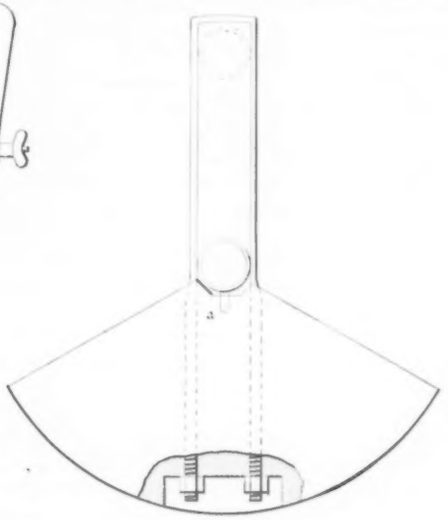


FIG. 7

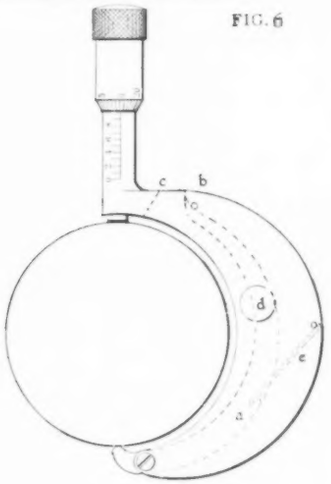


FIG. 8

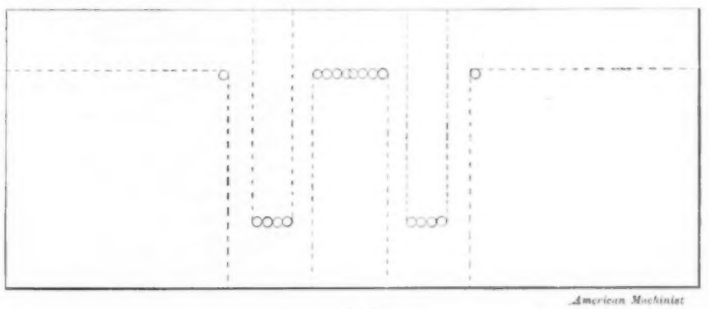


FIG. 9

A SAWMILL, A COUNTERWEIGHT AND AN INDICATING MICROMETER.

the micrometer over the work, when the long end of the lever shows that, say, .005 inch more is to be cut off the shaft to make it 3 inches.

Packing of Machinery for Export.

BY PAUL ROUX.

Those who have, or may have, to deal with the matter of packing machinery for export cannot know too much of the subject, and therefore a paper presented by Paul Roux before the American Chamber of Commerce of Paris possesses interest for many of our readers, Mr. Roux having had much experience with machinery imported into France. His paper is as follows:

This paper will give little new information to those familiar with the importation of machinery, nor to American manufacturers who, through their own experience and that of their agents, are conversant with what a machine-tool goes through from its completion and test in the home factory until finally running in some French establishment. It may, perhaps, be of value to those who are seeking a foreign market, and who have yet to learn the requirements of the export trade, and for this reason is submitted to the American Chamber of Commerce of Paris, whose principal object is to facilitate commercial transactions between the United States and France.

An American machine has much to pass through between the producing factory and its final arrival at the works of the purchaser: cartage, transportation by rail and by sea, transhipment, loading and unloading, custom house examination and, perhaps, storage for considerable periods in French warehouses.

Packing comprises the series of operations which have for object the preservation of the machine in good condition up to the time of final delivery. The care with which these operations are carried out, and combined, may not only largely affect their own cost, but also the expenses of transportation, custom dues and storage, and these expenses, in the case of machinery exported from the United States to France, may amount to a considerable percentage of the selling price.

Preparation of Machines.—All machine tools after having been completely assembled, inspected and tested in practical running, should be more or less completely dismounted before packing. It is impossible to lay down fixed rules in this regard, as the extent to which a tool should be dismounted varies with each machine, or, rather, with each class of machinery. The manufacturer must take into consideration the resistance of the tool and its various parts to rough handling in transportation, and decide upon to what extent it should be dismounted to insure safety. It must be remembered that while the packing-case will protect a machine against blows which it may receive when in a normal position, it offers little protection against side or abnormal thrusts resulting from an overhanging position. Great care must therefore be taken to see that no part of a machine is in contact with the sides of the case, that is not fully able to withstand the rough handling to which the case will be subjected. The feet of a lathe bed, the base of a shaper or of a milling machine, may be readily broken by the packing-case falling, even lightly, on one of its corners and without the latter showing any external evidence of the fall.

A most important consideration to be taken into account when dismounting a machine is its volume or cubage when packed for shipment. Marine freights are generally reckoned at so much per ton weight, or per 40 cubic feet, at the option of the ship. The exporter has, therefore, every interest to see that the weight, which cannot, of course, be varied, does not occupy a space greater than 40 cubic feet per ton. Nearly all machines, when not dismounted, make up into packages greatly exceeding 40 cubic feet per ton, and even under the best conditions can rarely be packed in cases equivalent in weight and volume. It may therefore be laid down as a general rule that every effort should be made to reduce the volume as much as possible by dismounting all projecting parts which increase the over-all dimensions of the packages. On the other hand, the difficulty of assembling parts requiring accurate adjustment must be taken into account, and the exporter must use his best judgment in deciding at what point the difficulties of setting up the machine will outweigh the economy realized by reducing the volume of the package.

This question of reducing the cubage is worthy of the closest attention of American manufacturers, as the freight from the United States to French ports is extremely high by the direct lines, while the extra duties charged upon goods arriving indirectly more than counterbalance any savings in transportation charges. The cost of transportation is therefore an important factor in the cost of a machine when delivered in France, and the economy realized by paying close attention to the volume of packages may form an appreciable portion of the profits.

The maximum weight of each package must also be carefully considered: freight charges, computed, as has already been shown, according to weight or volume, as may be more profitable to the carriers, are increased very considerably when the weight of individual packages exceeds a certain limit. For instance, the rate for packages exceeding 4½ tons in weight is double that for packages weighing less than 2 tons. This increase varies according to the steamship line, but is imposed by all and must therefore always be taken into account.

In addition to its effect on the actual freight charges, the total weight per package when exceeding a maximum of about 2 tons, involves extra charges for loading and unloading. These charges vary according to the equipment of the ports of departure and arrival, and are often very considerable—as it may be necessary to move the vessel under a dock crane, when one is available, or to get up steam on a floating crane to handle the heavy weights.

To sum up, it will generally be advantageous to dismount a machine weighing over 2 tons in order to pack it in several packages, each weighing less than this maximum. Care must be taken, however, that the total tonnage or cubage of the several packages does not exceed that of a single case, and that the difficulties of assembling the machine at destination do not more than counterbalance the economy realized on transportation charges. It is also profitable to dismount a machine weighing either more or less than 2 tons when this secures a considerable reduction in volume, and when, as is generally the case with machine tools, the cubage exceeds the limit of 40 cubic feet per ton.

Dismounting Fragile Parts.—It is generally necessary to dismount fragile projecting parts, even when this will have no influence on the volume or weight of the packages. While it is true that these parts will be properly protected by the packing-case during transportation, still they run the risk of being bent or broken during the operations of unpacking and setting up the machine. It is therefore preferable to remove them, and to pack them in one or more separate boxes secured in the principal case. All delicate or fragile parts which cannot be removed should be carefully protected against rough handling during unpacking. All screw threads should be carefully covered with wood or rags; all tapped holes, oil holes, and, in general, all openings through which dirt can reach the interior of the machine, should be carefully closed with wooden plugs.

Manufacturers are especially urged to tag all pieces which may have been removed, with labels fully explaining their position on the machine. This precaution may appear exaggerated and useless, if it is considered that the machines will only be assembled by mechanics understanding their construction, but certain American machines are novelties to many factories, and besides, before arriving at the works of the purchaser, the machine has to pass through the custom house, and sometimes to be exhibited in a salesroom. Under these conditions it is necessary that people unfamiliar with the type of machine should know exactly the position and function of each of the detached parts.

Preservation.—When a machine tool has been properly dismounted and divided for packing, the very important operation of protecting the finished parts against rust must be carried out. Lack of care and attention in this operation may have very

serious consequences. It is not necessary to point out what serious effects rust may produce on the finished parts of a machine; it should be remembered that after having passed three or four weeks *en route*, often badly protected from the rain, and always subjected to the effects of dampness, a machine may remain during long months in warehouses before being unpacked, and it is easily seen in what condition a machine may be found if the finished surfaces have not been protected against rust by a thoroughly efficient coating.

There are two things to be considered in this question of protection—the nature of the protective coating and the method of applying it. Without stating what the composition of the coating should be, it is urged that this should be sufficiently fluid at the time of application to permit it to reach all parts of the surfaces to be covered; that it should be entirely free from all trace of acid, in order that it may not attack the metal. It should dry very rapidly, in order that no surface should be exposed accidentally through chafing *en route* or careless handling in the custom house. It should be readily dissolved with oil, petroleum or turpentine when the machine is ready to be set up at its final destination.

The coating should, of course, be applied carefully to all polished surfaces which can be reached by the atmosphere, and care should be taken that the coating is intact after the machine has been packed—that is to say, when the packing-case has been constructed around the machine. It very often happens that the packers carefully coat all polished parts of a machine, but that more or less of the coating is removed during the handling necessary for placing the machine in its packing-case, or by contact with the interior braces. The effects of this negligence are generally very serious, because the parts thus exposed are promptly attacked by rust, and the machine cannot be put in perfect condition, even if this be possible, except by long and costly work.

Polished surfaces which are in contact with each other should not be coated; they will be sufficiently protected by the lubricating oil applied for running the machine. Likewise oil holes should be free from the coating composition, as it is most difficult to completely remove it later on.

Finally, it is recommended that this coating be not applied to any finished parts, which, by their position in the machine, are completely protected from all exterior contact, and which are so situated that the removal of the protecting coat would be difficult. For these parts the employment of vaseline or solidified oil is suggested, as this can be readily removed, and, even if not removed, cannot affect the working of the machine. The only precaution to be taken is that the vaseline and oil should be entirely free from acid. As an example, enclosed gearing, such as in the headstock of a lathe, can be protected in this manner against rust. Vaseline or solidified oil may also be employed for protecting such small detached pieces as may be enclosed in a separate box.

Packing-Cases.—The packing-case must fulfill two requirements: it must effectually protect the machine against all shocks and injury during transportation, and must facilitate the handling of the machine—that is to say, that the packing-case is at the same time a covering and a vehicle.

In order to fulfill this double requirement the case should be specially constructed, and, without fixing general rules, as the details of construction will vary considerably with the forms of different types of machines, the essential requirements will be given for packing-cases containing a machine which is of a weight too great for moving by hand.

The bottom is the important part of the case, considered as a vehicle. If this is well designed, it will not only facilitate handling during transportation from the United States to France and contribute greatly to removing risk of injury, but it is the only part of the case which can be utilized in France, if, after remaining in showrooms, it is to be shipped by rail to its final destination. The bottom should therefore be sufficiently strong to carry the total weight of the machine, without the assistance of any other part of the case, when balanced on a roller. It should be constructed with two longitudinal battens, in order that the case may be moved on rollers when cranes are not available, and these battens should be beveled at the ends to facilitate their employment. Transverse planking, spiked to the battens, forms the bottom of the case. On the bottom, constructed as indicated, two frames should be built around the machine, dividing the length of the case in three parts, in such manner as to support the pressure of ropes or chains when handling with cranes or other hoisting apparatus. These frames will at the same time act as supports for the interior braces, and as lateral supports in case the package is laid on its side, which often happens in spite of instructions. Around these principal elements are built the sides, ends and top of the case, which are designed simply for protecting the machine generally. In constructing the packing-case, the remarks already made regarding its volume must be borne in mind. This volume is computed from the over-all dimensions, and often a bolt-head or a batten badly placed will largely increase the cubage.

In designing the packing-case, it is very necessary to make provision for the examination of the machine in the custom house, and even for removing it completely. It is absolutely necessary in all events to arrange an opening in one of the sides or in the cover, through which the nature of the machine may readily be seen. This opening should be large enough to permit the examination of all parts of the interior of the case, and to permit the passage of a lantern, if required. It should be closed by a cover secured with screws.

To allow for removing the machine completely from the packing-case, in order to determine the net weight of the machine for the custom house, it should be arranged so that the packing and the unpacking may be readily and rapidly accomplished, without it being necessary to injure the panels. For this it is necessary that the top and one of the sides be secured with screws, instead of nails, and that the position of the interior battens and braces be indicated externally, in order that the screws and nails fixing them may be readily found.

It is especially recommended that the interior of packing-cases be not lined with paper. Such a lining prevents the circulation of air, and if the machine be packed in a damp atmosphere, the humidity, which under other circumstances would have evaporated, will attack the metallic parts wherever exposed ever so slightly. Special attention is called to this point, as practical experience has demonstrated that effects have resulted from lining cases quite unforeseen by the exporter.

Lists and Drawings.—It is very necessary that the machine should be accompanied by a detailed list of the detached pieces contained in the packing-case, which, on unpacking, will show whether any part has been lost during transportation or during the custom house examination. It is most indispensable that this list should be accompanied by a drawing or cut showing clearly the machine when assembled and ready for work. This cut should also show all accessories which are indispensable to the machine: for example, countershafts, keys and wrenches, change-gears, and so forth. This cut, in lieu of which a drawing should be supplied, will permit the custom house inspectors to convince themselves that the detached pieces actually form part of the machine; otherwise, these pieces may have to pay duties at a higher rate than the machine itself. If the machine has been taken apart and made up into several packages, a cut or drawing should be placed in each case, as in general all of the packages are not opened in the custom houses.

These papers, lists, cuts and drawings should be carefully enveloped in waterproof paper and tacked inside the case, near the small opening already mentioned, in order that they may be readily accessible. When the dimensions are such that the papers can be attached to the cover of the opening, this should be done.

Exterior Marks.—Once the packing is finished, it only remains to properly mark the cases for identification. All manufacturers know that a case should be marked legibly with identifying marks and numbers, the gross and net weight, the volume and the name of the port of

discharge, the latter in legible lettering at least 2 inches in hight. It is only necessary to call their attenti n to the necessity of marking the absolutely exact net weight, as even a very small difference between the weight stated and the true weight may cause difficulties in the custom house, and perhaps the imposition of fines. The volume is determined by taking the three dimensions over all. In addition to these marks, indispensable for the transportation of the package and which should, when possible, be placed on the sides of the case, it is recommended that on each end of the package a short designation of the contents be added. These last-named inscriptions are absolutely necessary when the package is to be stored in a warehouse, as they permit of the immediate identification of a case containing a given machine. These inscriptions should not only indicate the type of machine, but should also give its size or number.

Finally, exporters are urged to paint a black circle around the heads of all nails and screws which should be removed in order to unpack the machine with the least work, and without injuring the panels and bracings.

If the bottom of the case has been given the special form indicated above, there is little chance that it will be placed otherwise than upright; it is, however, better to add the usual indications—"top," "bottom," and so forth.

Conclusion.—If the above suggestions are carefully followed, manufacturers will greatly diminish the risk of injury or deterioration during transport, and will spare the consignee of the machine, and the purchaser, in France, the trouble, delay and expense which the loss, damage or breakage of an essential part of the machine will cause him. The importance of properly bracing and securing a machine in its packing-case has not been insisted upon, as the methods must vary greatly with each type of machine. The manufacturer should know how to so arrange the bracing that the stresses to which the case may be subjected will be properly distributed, and only brought to bear on such parts of the machine as may be capable of resisting them.

The one hundred and eighty-fifth meeting of the American Institute of Electrical Engineers will be held at the Chemists' Club, 108 West Fifty-fifth street, New York, Friday, March 25, at 8.15 P. M. The following papers will be presented for discussion: 1. The Relative Fire Risk of Oil and Air-Blast Transformers, by E. W. Rice, Jr. 2. Use of Group Switches on Large Power Plants, by L. B. Stillwell. 3. Oil Switches for High Pressures, by E. M. Hewlett. 4. Terminals and Bushings for High-Pressure Transformers, by Walter S. Moody.

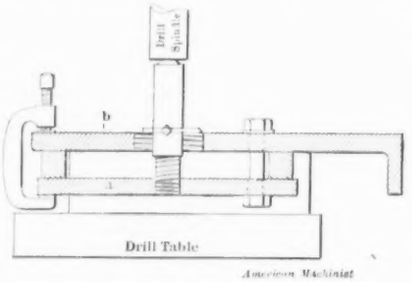
Letters From Practical Men.

Tapping Large Work in a Drill Press Without a Tap.

Editor American Machinist:

In a small machine shop whose business it is to repair anything from a pocket-knife to a locomotive, the ingenuity of the machinist in charge is more often put to the test of devising new ways of doing a job than anywhere else,

A few days ago a broken apron belong-



A VERTICAL LEAD SCREW.

ing to a large lathe was brought to me for repairs, to be returned in three days' time. The stripping of the parts, molding, and casting the new apron left but one day to machine it. Two of the large gear studs to be refitted were threaded ten to the inch, but there being no lathe large enough to swing the apron, chasing a thread in this manner was out of the question. Accordingly, the tip of the boring bar used for making the holes was turned down to ¾ inch and threaded ten threads per inch. An ordinary iron strap *a* was tapped to match and clamped just below the apron *b* to be threaded as shown in the accompanying sketch, the strap acting as a leader for a thread-cutting tool which was inserted in the boring bar. THOS. J. BROWN.

An Exciting Lathe Contest—A Roughing and Finishing Boring Tool.

Editor American Machinist:

There was a very exciting contest in our works some time ago. An order had come through for some special machines, which had to be delivered at a certain date, failing which the order would be cancelled, and consequently the machines would be left on our hands. As it was a big order, our firm were most anxious to oblige, for they had been given to understand that its satisfactory completion in the specified time would bring more grist to the mill. Our chief at once ordered us on full time, for which we were very glad, for Christmas was drawing near, when most of us like to feel the satisfaction that a fat pocket gives. Everything was progressing favorably, with the exception of some of the turned work, the delay of which considerably hampered the progress of other operations. It began to look serious, as we were rapidly approaching the date when the machines would have to be delivered. To get this turned work quickly, the ninety pieces required were divided between three men, and to add extra stimulus to the affair a prize of ten shillings was promised to the man who had his thirty finished first. The betting was 5 to 4 on Smith, who, so it was said, had a slight advantage over the other two, as he was working on a Yankee lathe. Now, I have frequently noticed that as soon as a Yankee lathe became vacant some of the hands would be round the foreman's office asking to be allowed to shift on to it. I don't want to say anything against English lathes, but I simply state the facts as they are. There was great cheering when the start took place. They kept fairly close together till the fifth piece was reached, when Smith had the misfortune to break his big boring tool, much to the delight of the other two. Three to one was instantly offered against Smith now winning. He was soon down on his knees, rummaging about in his tool box under the lathe, and finding something which was evidently to his satisfaction, he quickly made for the hardening shed, coming back again in about half an hour with his new tool hardened and ground. He had it fixed up in position in the twinkling of an eye-lid. But not until the other two had gained two on him. Anyhow, he stuck to it, and at the fifteenth piece he was only one behind. The excitement was growing intense; even the manager came round to see how the battle waged. At the twenty-fifth piece Smith once more drew level, amid great cheering, in which everyone joined, from the foreman down to the little shop lads. This seemed to unnerve the other two, for Smith now drew right away, winning in a canter, nearly two to the good. Smith told me afterwards that he owed his success to his tool breaking. When he was rummaging in his box, he came across a boring tool which he had made some time back and which required only hardening and grinding to be ready for use. It was fortunately just the thing for the job on hand.

COMBINED ROUGHING AND FINISHING BORING TOOL.

The pieces had to be bored and turned, the holes being cored out to within ¼ inch of the finished size. They were first

rough and then finish bored. Now, the other two fellows roughed the holes out with the rough boring tool held in the tool-post, after which they would take the tool out and replace it with a finishing tool. In the changing of the tools lay the secret of Smith's success. The tool he had found in his box was a combined roughing and finishing tool, as shown in the accompanying sketch, and the use of which saved the time the other two fellows lost in changing. Besides winning the ten shillings, he also won for himself the title of champion quick turner of the works. Thus ended the great contest.

CHERRY RED.

Coventry, England.

Reamer for Saw Arbor Bearings.

Editor American Machinist:

Fig. 1 in the accompanying drawing illustrates a saw arbor running in babbitt boxes with a thrust bearing formed near one end, Fig. 2 shows the reamer for finishing the bearings, and in Fig. 3 the reamer is shown in working position.

This reamer is turned about .02 inch large, then the flutes are milled, and the tool hardened and straightened if necessary, after which it is ground to correct diameter and clearance ground back of each cutting edge as with any ordinary reamer. The spacing of the flutes should be irregular, as shown, since this insures a very smooth bearing, entirely free from chatter marks.

In babbitting the bearings, I use a special arbor, slightly smaller in diameter and with narrower V-grooves than the saw arbor. The reamer is then placed inside the boxes, and pasteboard liners enough inserted between the boxes and caps, so that the cap screws will tighten against the liners and pinch them slightly, at the same time exerting just enough pressure on the reamer so that when it is rotated by means of a wrench a light cut is taken on the babbitt surfaces. As the reamer turns more freely, the cap screws are tightened evenly, and occasionally a liner is removed from under each cap. The reamer will in a very short space of time bring caps and boxes down to a beautiful bearing, saving an immense amount of time in scraping (as by old methods)—and this will be better appreciated when it comes to the actual running test of the completed machine.

The V-ribs are left untouched by the reamers, but will be found to require very little attention with the scraper, once the reamer has finished the other surfaces.

The V-grooves in the saw arbors are uniform, as they are cut in by rough and finish forming tools and afterwards hand tooled. The arbors are ground and polished.

C. B. C.

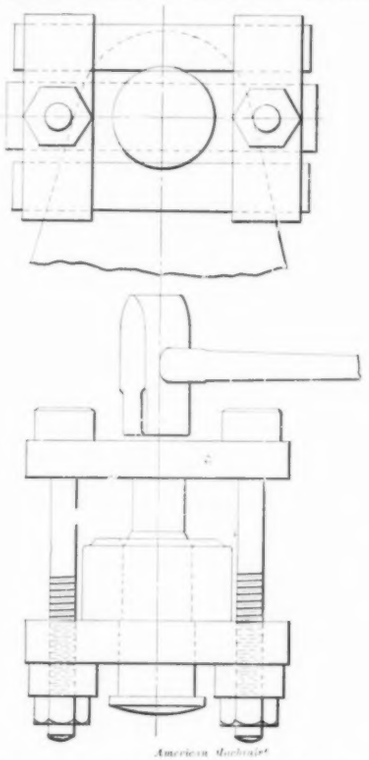
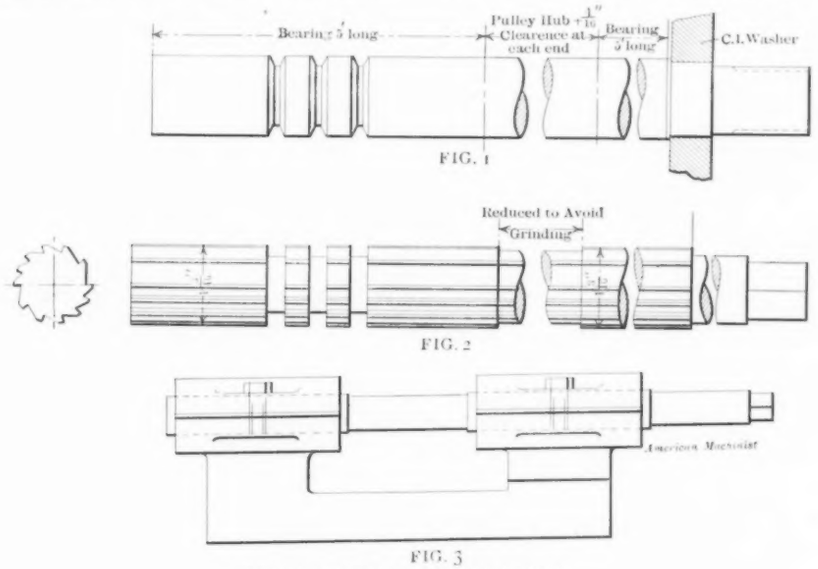


FIG. 1. GETTING THE CRANK PIN OUT.



THE SAW-ARBOR REAMER AND WORK.

A Crank-Pin Repair Job.

Editor American Machinist:

The crank pin on the engine had been giving trouble for some time. It was decided to take it out, straighten the hole and put in a new pin, and, as usual, this had to be done on Saturday night so as to be sure to have it ready to run Monday morning.

Not expecting it to come out very hard, we chipped off the riveting from the end of the crank pin, then took five heavy pieces of machine steel and two 1½-inch bolts, applied them as in Fig. 1, putting a short piece of 3-inch shafting between clamp *a* and the end of the pin, screwed up our bolts as tight as a 3-foot wrench would do it, at the same time using a 20-pound sledge as a persuader, and after a little forcible urging along this line Mr. Crankpin concluded to move.

The intention was only to scrape the hole; but after the pin was out we found it so bad that we had to drop the idea of scraping and find some other more aggressive way of truing it. Picking up two unfinished air-hoist heads, we faced them off and bored them to fit a boring bar we had around the shop; put these on the crank as shown in Fig. 2, using a pair of 1-inch parallel strips as distance pieces, and a No. 3 Renshaw ratchet for turning and feeding the bar. To keep the cutter

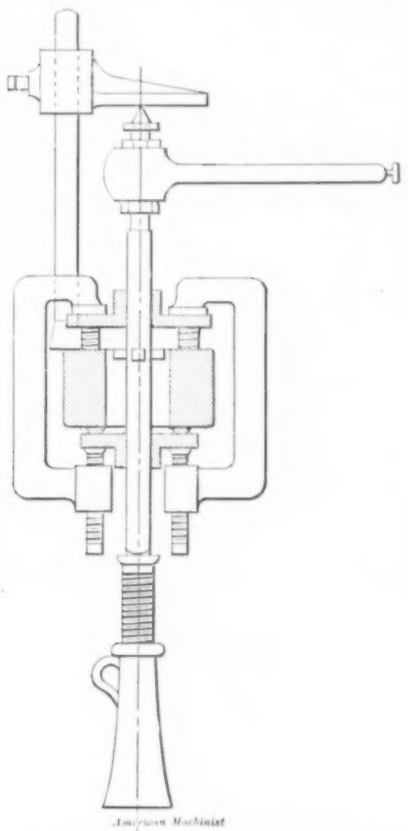


FIG. 2. REBORING THE CRANK-PIN HOLE.

from slipping ahead we blocked a jack-screw, which just happened to be handy, between an arm of the flywheel and the other end of the boring bar, feeding the screw back as the boring bar with the cutter went ahead. In this manner we succeeded in getting a good, straight crank-pin hole in a very short time. There certainly are better means for doing jobs of this kind, but this is a good way when you have no other means at hand.

FRED. J. KUHLMANN.

Support for Drill Press Work—Hollow Mill Holder—Screw Slotting Rig.

Editor American Machinist:

Fig. 1 shows a handy appliance for the drill press. It is a triangular cast-iron affair, with sides and bottom ½ inch thick. The depth can be made to suit the work in hand. It is planed off on top and bottom, and will be found very useful not only for holding work but also in preventing people from drilling the table full of

FIG. 1. SUPPORT FOR DRILL-PRESS WORK.

holes, as some are apt to do when there is nothing handy to put under the work.

Some time ago I had a lot of small wooden rods to mill to size on one end and found some difficulty through the work running to one side, and also found trouble in keeping a standard size until I tried the tool shown in Fig. 2. I took a piece of machinery steel and fitted it to the screw-machine turret, drilled a hole through it, bored it out to fit the hollow mill, cut four slots through the shell to let the chips out and fitted a bushing to the front end to guide the rods, put in a headless set-screw to hold the hollow mill and another to hold the bushing, and the trouble ceased at once.

I had to make an impromptu rig to slot a lot of small screws, and the best place to do the job, I thought, was in the special lathe. So I took a pair of blacksmith tongs and knocked the rivet out, made a stud to fit the tool rest, put a bolt through the tongs and stud, adjusted the tongs on the center of the saw arbor and so as to get the right depth of slot in the screw—all as shown in Fig. 3—and the boss was a little surprised at the quantity a boy could slot and without making any mistakes.

BARLOW.

Cast Iron or Gray Iron.

Editor American Machinist:

It is incomprehensible how so eminent an authority as the AMERICAN MACHINIST can so persistently continue to use the term "cast iron" when alluding to work or castings made of gray iron. While it is true that this appellation is descriptive of the material in a broad sense, still, as it is just as applicable to malleable or white hard iron castings as to gray iron, neither has the right to monopolize it. The excuse that this term is generally used for gray iron is hardly a sufficient reason for the continuance of the practice. Persons that know better should stop it, and those who do not know to the contrary should be taught. No one would think of embracing all the kinds of steel under the general name of steel, but the descriptive names of tool steel, machinery steel are made use of, to make clear what is referred to. Following the same idea, why not use the names gray iron, white iron and malleable iron castings for the respective kinds, in which case there would be no chance for a question to arise as to which was meant? The term "gray iron" is a concise, clear description of the material, certainly as brief as the term "cast iron," so that there can be no objection as to its length—surely, G. I. would look as well on drawings as C. I. As this is an age of improvement, why is it not an opportune time to change the custom that has been prevailing for years and give one of the most important of all materials its true name, thus preventing the misunderstandings and controversies that are sure to continue so long as the present practice remains in force? A number of years ago a prominent house in New York city requested a quotation on some "cast iron" castings. They were quoted on gray iron castings, which they ordered and, on attempting to bend the pieces that were furnished, found they would break. They complained of the castings being brittle and were told that they evidently required malleable castings, but as their inquiry was for "cast iron castings," there was no means of determining what they did want. However, as they were furnished that for which the quotation called, their only course was to pay the bill, which they did. Only recently a party sent a pattern for some cast iron castings to a foundry making gray iron castings. Upon filling the order, it developed that he wanted hard white iron castings. How is the foundryman to know what is wanted, unless the proper term is used in the order? and it is for this purpose that your co-operation is solicited in inaugurating a reform. This letter is not designed for publication, but simply for the purpose of calling your attention to a subject that seems to have had but little thought.

I. S. SPENCER'S SONS.
Per F. C. SPENCER.

Guilford, Conn.

[By subsequently given consent we publish the above letter, and in relation to it will say that we think it is better to use the term gray iron and we shall do so hereafter, asking all our contributors to do the same. We fear, however, that whatever the usage of technical journals such as ours may be will make little difference to the foundries which receive orders from people who, wanting malleable castings, order "cast iron castings" or, wanting

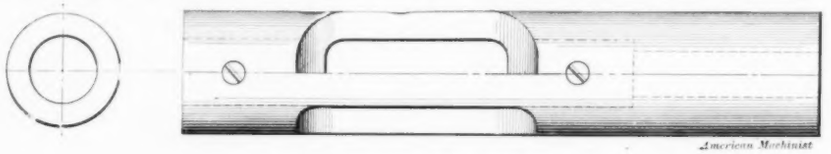


FIG. 2. HOLLOW MILL HOLDER.

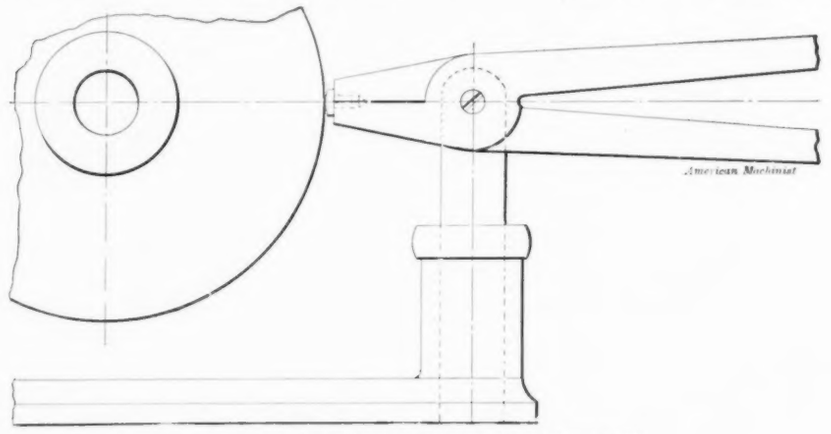


FIG. 3. RIG FOR SLOTTING SCREWS IN SPEED LATHE.

"white iron castings," order the same things. People who do such things don't read technical journals that deal with foundry matters to any extent, and will probably go on giving blind orders no matter whether we say cast iron or gray iron. Nevertheless we shall say gray iron hereafter because it is right.—Ed.]

Making Flat End Gages.

Editor American Machinist:

The making of flat-end gages or end measure test gages is generally supposed to be a difficult job, and experience has taught me that the supposition is a correct one.

Gages are of course made with various degrees of accuracy, but we will take up the making of a test piece which is right and will stand the test in every way.

Most gages 3 inches or over in length are made like Fig. 1 because they are easier to make, the ends being turned a little smaller than the body, as shown, so that after hardening cat-heads may be fitted on the ends and the body ground true and parallel, this making a cheap method of truing up and finishing. These round gages have a faculty of rolling away and getting lost, and for that reason I do not think they are as desirable as square ones, although the rig described will make them equally well.

FIG. 1

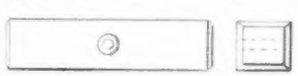


FIG. 2

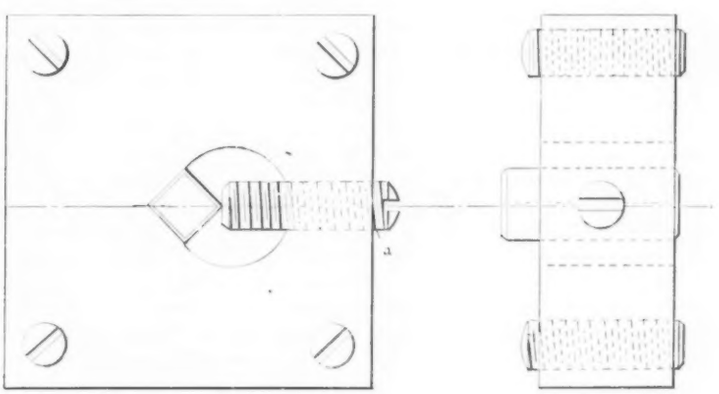


FIG. 3

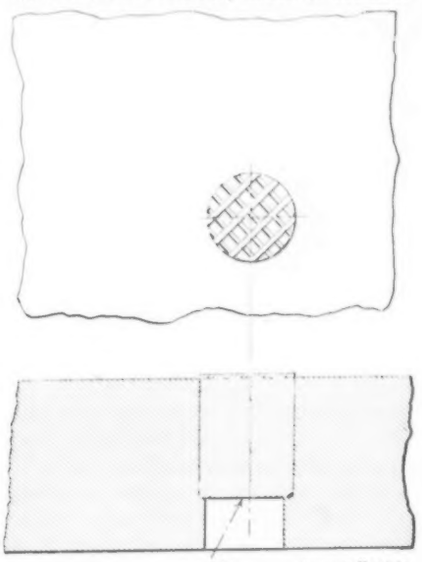


FIG. 4

LAPPING JIG AND BLOCK FOR FLAT END GAGES.

To make a 1-inch standard test piece such as the Pratt & Whitney Company furnish, and which is shown in Fig. 2, a piece of tool steel of 110 point carbon is milled 11-32 inch square and to a length of about .01 over 1 inch, after which the corners are milled with a 45-degree cutter, leaving the end surfaces to be finished about ¼ inch square. Next a 3-32 inch hole is drilled in the middle and countersunk with a center reamer; and after the corners have been nicely rounded the gage is ready to harden.

To get the best results, it should be packed and the ends hardened in oil, as the oil will give a nice dead-black finish. Next two adjacent sides are ground on a surface grinder and lapped square.

Now we are getting where things *must* be right, so we will test with a knife edge square, drawing the fingers crosswise over the gage and then drawing the square endwise and noting the marks made by the blade in the moisture left on the surface by the fingers. This, to my notion, is better than the light test.

We are now ready to finish the ends, and for this a piece of cast iron 3 inches square and ¾ inch thick, as shown in Fig. 3, will do, care being taken to have the corner screws tapped in square and a snug fit, and the corner for the gage scraped to a good surface, for we must be able to remove the gage and return it to absolutely the same position. Next, this lapping jig is placed on a true mandrel, secured by screw *a*, and the corner screws adjusted on the lathe center with a test indicator. We now place the jig on the surface grinder with the gage in position, as shown, and grind one end.

The plate in Fig. 4 is now needed. It is of cast iron with a ½-inch brass plug *b* driven securely in, planed off 1-16 inch above the surface and checked as shown. A drop of oil and a pinch of flour of emery (diamond dust is better) are placed on plug *b*, the jig is placed in position, and the gage dropped into place and secured by screw *a* with the ground end down, care being taken not to turn *a* so tight as to spring the jig.

It becomes interesting now. Tapping the gage lightly with a piece of brass rod to seat it on the lapping plug, it is lapped until the surface is cleaned up, when it is removed from the jig and tested with the knife edge square, notice being taken of the way the jig is out; the corner screws are then adjusted to correct the error and the lapping process is repeated. This is kept up until the end is square with both finished sides and it *must be right*, for any error here will be doubled when the other end is finished.

When the end is square and a suitable surface secured, the jig is placed on the surface grinder, the other end ground, leaving about 0.00025 inch to finish—or less if the wheel is fine and true—and the lapping process repeated. This time, as the jig is adjusted, we have to deal with the length only, but great care must be taken now. New abrasive material must not be put in the lapping plug when near the finish, or scratches will be made that cannot be taken out without making the gage too short; and the work must not be handled, as it will expand with the heat of the hands, so a small stick is thrust into the hole at this point to hold it while measuring.

One of these little blocks of steel that is *right* may not look very much to the average eye, but it is a work of art nevertheless.

A set, all square, consisting of 1, 3 and 5 inch, rest in one of the drawers of my long unused tool chest. They were made to set a 6-inch beam micrometer constructed in the days when there was but one make of micrometer on the market and the thread on that ran the entire length of the spindle.

These were tested by Mr. Geo. M. Bond, of the Pratt & Whitney Company, who pronounced the 5-inch "fair," the 3-inch "pretty good," and the 1-inch "O. K.," but the one O. K.d was not the first one started by several. THEODORE.

Chordal Pitch.

Editor American Machinist:

As the subject of "Chordal Pitch" has lately been brought to the attention of your readers, I should like to say a few words on this topic.

Of course, from the standpoint of kine-

matics the chordal pitch is an absurdity, yet it can be shown that its adoption was not without reason.

The use of the chordal pitch dates back to the time when the shape of the teeth was determined by an empirical rule found by experiments instead of kinematic reasoning, and it was no doubt found that gearing made to dimensions computed on basis of the chordal pitch worked better than if made to the rule of arc pitch. To be sure the difference became apparent only when pinions of a low number of teeth were in question. Why should this be so?

Lately it has become the practice with some firms to give pinions of a low number of teeth an addendum greater and a dedendum less than normal, for the purpose of avoiding, or at least reducing, the effect of interference between the points of the teeth of wheels and the flanks of pinions. The outside diameters of pinions are accordingly made greater than demanded by a normal addendum. This is done for well-known kinematic reasons. Now it happens that pinions made to chordal pitch are greater in diameter than those made to arc pitch. Practice has proved them to be superior to the smaller pinions, but the reason for this difference was misunderstood. The adoption of the chordal pitch was considered the cause, while we now know that the increase of addendum and corresponding decrease of dedendum should receive the credit.

HUGO BILGRAM.

German Foreign Trade in Machinery for 1903.

The statistics of the German Customs District for 1903 show as follows:

Machinery and machine parts, extending to locomotives and automobiles and boilers were imported to the quantity of 59,046 tons, valued at 51,708,000 marks,* against 51,488 tons at 45,301,000 marks in 1902. They were exported to the amount of 248,208 tons at 208,740,000 marks, as compared with 218,781 tons at 183,288 marks in 1903.

Among the countries from which the imports came was the United States, with 13,111 tons in 1903 and 14,446 tons in 1902; Belgium, 1,538 in 1903 and 1,099 in 1902; Denmark, 384 in 1903 and 252 in 1902; France, 2,169 in 1903 and 1,791 in 1902; Great Britain, 25,316 in 1903 and 20,364 in 1902; Italy, 204 in 1903 and 194 in 1902; Netherlands, 1,382 in 1903 and 476 in 1902; Austria-Hungary, 3,172 in 1903 and 2,505 in 1902; Sweden, 719 in 1903 and 353 in 1902; Switzerland, 5,393 in 1903 and 4,605 in 1902; British North America, 1,362 in 1903 and 1,209 in 1902.

Among the countries to which exported were the following: United States, 3,874 tons in 1903 and 3,152 tons in 1902; Belgium, 15,113 in 1903 and 16,648 in 1902; Denmark, 4,112 in 1903 and 3,485 in 1902; France, 21,276 in 1903 and 24,844 in 1902; Greece, 294 in 1903 and 118 in 1902; Great Britain, 22,556 in 1903 and 19,034 in 1902; Italy, 15,760 in 1903 and 13,775 in 1902; Netherlands, 15,065 in 1903 and 12,464 in 1902; Norway, 1,632 in 1903 and 1,694 in 1902; Austria-Hungary, 25,396 in 1903 and 22,945 in 1902; Portugal, 748 in 1903 and 188 in 1902; Roumania, 2,577 in 1903 and 1,648 in 1902; Russia, 36,671 in 1903 and 33,137 in 1902; Finland, 1,747 in 1903 and 1,740 in 1902; Sweden, 5,799 in 1903 and 5,485 in 1902; Switzerland, 8,731 in 1903 and 7,385 in 1902; Servia, 142 in 1903 and 107 in 1902; Spain, 11,759 in 1903 and 8,914 in 1902; Turkey, 554 in 1903; Egypt, 1,030 in 1903 and 914 in 1902; British East Africa, 155 in 1903; British South Africa, 1,511 in 1903 and 326 in 1902; Transvaal, 3,446 in 1903 and 1,649 in 1902; Portuguese East Africa, 722 in 1903 and 86 in 1902; British East India, 5,841 in 1903 and 148 in 1902; China and Hong Kong, 563 in 1903 and 285 in 1902; Kiaochau, 3,701 in 1903 and 452 in 1902; Japan, 947 in 1903 and 1,265 in 1902; Dutch Indies, 2,116 in 1903 and 2,082 in 1902; Argentina, 3,655 in 1903 and 2,275 in 1902; Brazil, 801 in 1903 and 610 in 1902; British North America, 1,925 in 1903, and 336 in 1902; Chile, 1,720 in 1903 and 914 in 1902; Mexico, 1,860 in 1903 and 1,125 in 1902; Cuba and Porto Rico, 150 in 1903 and 331 in 1902.

Machine tools imported were 2,364 tons (1,891,000 marks) in 1903 against 1,892 tons (1,514,000 marks) in 1902. The principal countries from which imported were the United States, 1,142 tons against 698 in 1902; France, 137 tons against 72 in 1902; Great Britain, 315 tons against 446 in 1902; Austria-Hungary, 166 tons against 223 in 1902; Sweden, 146 tons against 113 in 1902; Switzerland, 128 tons against 53 in 1902.

Machine-tool exports were 20,465 tons (14,326,000 marks) in 1903 against 21,055 tons (14,738,000 marks) in 1902. Countries to which exported included United States, 182 tons against 232 in 1902; Belgium, 1,421 tons against 2,408 in 1902; Denmark, 388 tons against 383 in 1902; France, 2,506 tons against 3,142 in 1902; Great Britain, 2,073 tons against 1,604 in 1902; Italy, 1,615 tons against 1,262 in 1902; Netherlands, 1,063 tons against 1,007 in 1902; Austria-Hungary, 2,892 tons against 2,426 in 1902; Roumania, 192 tons against 212 in 1902; Russia, 3,218 tons against 3,246 in 1902; Finland, 149 tons against 107 in 1902; Sweden, 793 tons against 717 in 1902; Switzerland, 1,327 tons against 995 in 1902; Spain, 687 tons against 953 in 1902; China and Hong Kong, 318 tons against 207 in 1902; Dutch Indies, 151 tons against 217 in 1902; Argentina, 215 tons against 129 in 1902.

It is curious to note the results obtained by dividing the total quantities of machine-tool imports and exports into their respective valuations. For the imports we obtain an average value of almost exactly 800 marks per ton both for 1903 and 1902, while the exports show 700 marks a ton for each year. These approximations are so close as to suggest that the valuations have been computed in some wholesale fashion. They show, however, a general estimate of the value of machine tools imported into Germany at $200 per English gross ton, machine tools exported from the Empire being reckoned at $175.

Locomotives and steam road rollers were imported to the amount of 665 tons in 1903, as compared with 495 tons in 1902, the supply being chiefly from Great Britain in both years. The exports in 1903 were 19,310 tons compared with 14,043 tons in 1902. Among the countries to which exported, France showed only 608 tons in 1903 against 2,758 tons in 1902. Great Britain bought more than she sold, taking 472 tons in 1903 and 676 tons in 1902. Italy's share was 1,438 tons in 1903 and 1,846 tons in 1902. Russia bought 260 tons against 399 tons in 1902. Spain absorbed 4,628 tons, as compared with 2,308 tons in 1902. The British East Indies procured 5,579 tons and British North America 1,161 tons, in 1903, neither country having been in the German locomotive market the previous year.

Locomobiles (portable engines) were imported to the extent of 1,459 tons in 1903 and 1,369 tons in 1902, almost exclusively from Great Britain. There were exported of them 6,613 tons in 1903 and 5,694 tons in 1902. The chief customer was Russia, which bought 4,070 tons in 1903 and 3,177 tons in 1902.

Locomotives, steam road rollers and locomobiles are reckoned together in computing values which for imports amounted to 1,812,000 marks in 1903 against 1,589,000 marks in 1902; and for exports 27,102,000 marks in 1903 against 20,500,000 in 1902.

Motor cars, not to run on rails, were imported to the quantity of 564 tons (5,077,000 marks) in 1903 and 395 tons (3,554,000 marks) in 1902. France furnished most—408 tons in 1903 and 291 tons in 1902. The United States made a poor second in 1903 with 49 tons, having furnished only 10 tons in 1902. Exports were 588 tons (5,288,000 marks) in 1903 and 527 tons (4,741,000 marks) in 1902. France absorbed 170 tons in 1903 and 110 tons in 1902; Great Britain, 126 tons in 1903 and 132 tons in 1902; the United States, none either year.

Steam boilers with tubes were imported to the amount of 377 tons (426,000 marks) in 1903 and 168 tons (189,000 marks) in 1902. The exports were 4,146 tons (1,990,000 marks) in 1903 and 5,105 tons (2,450,000 marks) in 1902. The same without tubes were imported to the extent of 185 tons (67,000 marks) in 1903 and 72 tons (26,000 marks) in 1902. The exports were 2,473 tons (791,000 marks) in 1903 and 2,611 tons (836,000 marks) in 1902.

Agricultural machinery imports were 15,594 tons (13,255,000 marks) in 1903 and 17,713 tons (15,056,000 marks) in 1902. The chief countries from which they came were

* A mark equals about 24 cents, while the tons used, being metric, equal 2,205 pounds.

United States, 9,889 tons in 1903 and 12,138 tons in 1902; Great Britain, 2,676 tons in 1903 and 2,929 tons in 1902; British North America, 1,362 tons in 1903 and 1,209 tons in 1902. Exports were 14,450 tons (10,838,000 marks) in 1903 and 12,948 tons (9,711,000 marks) in 1902. They went most largely to Russia—7,045 tons in 1903 and 6,210 tons in 1902. The Netherlands, as reported, stood next with 1,304 tons in 1903 and 1,298 tons in 1902. The United States took none either year. It is likely that many engines for agricultural purposes are classed under locomobiles.

Electrical machinery imports were 1,009 tons (1,615,000 marks) in 1903 and 1,434 tons (2,295,000 marks) in 1902. From the United States came 63 tons in 1903 and 135 tons in 1902; Austria-Hungary, 247 tons in 1903 and 333 tons in 1902; Switzerland, 399 tons in 1903 and 518 tons in 1902. Exports were 13,576 tons (21,721,000 marks) in 1903 and 13,450 tons (21,520,000 marks) in 1902. The countries to which exported included Belgium 1,231 tons in 1903 and 972 tons in 1902; Great Britain, 3,620 tons in 1903 and 4,667 tons in 1902; Italy, 1,089 tons in 1903 and 1,076 tons in 1902; Russia, 1,234 tons in 1903 and 1,406 tons in 1902; Spain, 916 tons in 1903 and 837 tons in 1902; Transvaal, 128 tons in 1903 and 93 tons in 1902; Japan, 178 tons in 1903 and 132 tons in 1902; Argentina, 480 tons in 1903 and 407 tons in 1902; Chile, 124 tons in 1903 and 112 tons in 1902; Mexico, 179 tons in 1903 and 178 tons in 1902. The United States are not reported as having imported electrical machinery from Germany in 1903 or 1902.

Cotton spinning machinery imports were 7,215 tons (5,411,000 marks) in 1903 and 5,552 tons (4,164,000 marks) in 1902. Most of it came from Great Britain, a little from Switzerland and France. Exports were 3,505 tons (2,804,000 marks) in 1903 and 4,205 tons (3,364,000 marks) in 1902. To France went 1,614 tons in 1903 and 2,221 tons in 1902. Austria-Hungary, Russia and Great Britain followed far behind.

Weaving machinery imports were 4,463 tons (2,455,000 marks) in 1903 and 3,545 tons (1,950,000 marks) in 1902. From Great Britain came 2,451 tons in 1903 and 1,765 tons in 1902; from Switzerland, 1,061 tons in 1903 and 1,247 tons in 1902. Exports were 8,090 tons (4,854,000 marks) in 1903 and 8,590 tons (5,154,000 marks) in 1902. To Austria-Hungary went 1,619 tons in 1903 and 2,209 tons in 1902; to France, 1,184 tons in 1903 and 851 tons in 1902; to Italy, 1,148 tons in 1903 and 1,181 tons in 1902; to Russia, 962 tons in 1903 and 1,279 tons in 1902; United States, 387 tons in 1903 and 251 tons in 1902.

Wool-working machinery was imported to the value of 972,000 marks in 1903 and 988,000 marks in 1902, while the exports were 4,017,000 marks in 1903 and 2,328,000 marks in 1902.

Steam engine imports were 2,987 tons (2,091,000 marks) in 1903 and 2,417 tons (1,692,000 marks) in 1902. Great Britain furnished 692 tons in 1903 and 801 tons in 1902; Switzerland, 1,090 tons in 1903 and 762 tons in 1902; Austria-Hungary, 282 tons in 1903 and 486 tons in 1902. The exports were 22,464 tons (16,848,000 marks) in 1903, 21,842 tons (16,381,000 marks) in 1902. To Belgium went 1,185 tons in 1903 and 1,578 tons in 1902; France, 1,810 tons in 1903 and 2,905 tons in 1902; Great Britain, 7,360 tons in 1903 and 5,296 tons in 1902; Italy, 1,159 tons in 1903 and 880 tons in 1902; Netherlands, 1,798 tons in 1903 and 2,009 tons in 1902; Russia, 2,578 tons in 1903 and 2,598 tons in 1902; Portuguese East Africa, 145 tons in 1903 and 3 tons in 1902; Transvaal, 134 tons in 1903 and 121 tons in 1902; Japan, 247 tons in 1903 and 42 tons in 1902; Dutch Indies, 181 tons in 1903 and 110 tons in 1902; Argentina, 660 tons in 1903 and 368 tons in 1902; British North America, 210 tons in 1903, none recorded for 1902; Chile, 153 tons in 1903 and 141 tons in 1902; Mexico, 249 tons in 1903 and 125 tons in 1902; United States, 439 tons in 1903 and 394 tons in 1902.

Pump imports were 1,000 tons (981,000 marks) in 1903 and 649 tons (584,000 marks) in 1902. From Switzerland came 427 tons in 1903 and 177 tons in 1902; from the United States, 194 tons in 1903 and 161 tons in 1902. Exports were 8,416 tons (7,574,000 marks) in 1903 and 5,260 tons (4,734,000 marks) in 1902. To Austria-Hungary went 1,486 tons in 1903 and 1,059 tons in 1902; Russia, 1,284 tons in 1903 and 972 tons in 1902; Transvaal, 176 tons in 1903 and 118 tons in 1902; Dutch Indies, 121 tons in 1903 and 88 tons in 1902; Argentina, 224 tons in 1903 and 50 tons in 1902; Chile, 125 tons in 1903 and 65 tons in 1902.

"Fans for factory driving" were imported to the amount of 119 tons (83,000 marks) in 1903 and 79 tons (55,000 marks) in 1902. From Austria-Hungary came 42 tons in 1903 and 10 tons in 1902; from the United States, 23 tons in 1903 and 4 tons in 1902. Exports were 603 tons (482,000 marks) in 1903 and 484 tons (388,000 marks) in 1902. They went largely to Austria-Hungary and Russia.

Blowing machinery (or blowing engines) was imported to the amount of 326 tons (288,000 marks) in 1903 and 465 tons (326,000 marks) in 1902. Most of it came from Belgium. The exports in this line were 254 tons (177,000 marks) in 1903 and 1,199 tons (839,000 marks) in 1902. Among the purchasers were France, Russia and Italy.

Rolling machinery imports were 669 tons (301,000 marks) in 1903 and 378 tons (170,000 marks) in 1902. Great Britain and Austria-Hungary were prominent sellers. Exports were 6,928 tons (3,464,000 marks) in 1903 and 5,491 tons (2,745,000 marks) in 1902. To Belgium went 1,885 tons in 1903 and 1,723 tons in 1902; France, 2,171 tons in 1903 and 1,865 tons in 1902; Italy, 672 tons in 1903 and 160 tons in 1902; Russia, 278 tons in 1903 and 319 tons in 1902; Spain, 152 tons in 1903 and 208 tons in 1902; Japan, 213 tons in 1903 and 205 tons in 1902.

Machinery for cutting and punching metals which may be assumed to mean punches and shears and, possibly, presses, was imported to the extent of 356 tons (178,000 marks) in 1903 and 220 tons (110,000 marks) in 1902. From the United States came 192 tons in 1903 and 31 tons in 1902. The exports were 2,503 tons (1,376,000 marks) in 1903 and 1,688 tons (929,000 marks) in 1902. To Great Britain went 328 tons in 1903 and 114 tons in 1902; Italy, 204 tons in 1903 and 190 tons in 1902; Russia, 319 tons in 1903 and 266 tons in 1902; United States, 182 tons in 1903 and 177 tons in 1902.

Hoisting machinery imports were 1,611 tons (1,208,000 marks) in 1903 and 874 tons (656,000 marks) in 1902. Great Britain furnished 144 tons in 1903 and 354 tons in 1902; Italy, 204 tons in 1903 and 194 tons in 1902; Netherlands, 871 tons in 1903 and 8 tons in 1902; Austria-Hungary, 146 tons in 1903 and 47 tons in 1902; Switzerland, 85 tons in 1903 and 120 tons in 1902. The exports were 14,857 tons (10,132,000 marks) in 1903 and 13,267 tons (9,047,000 marks) in 1902. To Belgium went 577 tons in 1903 and 3,850 tons in 1902; Netherlands, 2,209 tons in 1903 and 544 tons in 1902; Russia, 466 tons in 1903 and 690 tons in 1902; British South Africa, 632 tons in 1903 and 44 tons in 1902; Portuguese East Africa, 188 tons in 1903; Transvaal, 291 tons in 1903 and 219 tons in 1902; Kiaochau, 3,654 tons in 1903 and 49 tons in 1902; Argentina, 224 tons in 1903 and 190 tons in 1902; Chile, 207 tons in 1903 and 84 tons in 1902.

In the foregoing statistics the countries we have mentioned in connection with various classes of machinery have not invariably been those with the largest quantities accredited to them. The selection has had regard to interest as well as amount, as where sometimes, for instance, South American countries were specified in preference to European ones whose actual totals were larger.

There are also given in the classified list several other sorts of machinery, some of which are dealt in quite extensively.

An interesting commentary on the success of German colonial enterprises is found in the columns headed German East Africa, German Southwest Africa and German West Africa. These columns are utterly blank in the machinery lines except that 4 tons of locomotives or steam rollers are entered under German Southwest Africa for 1902. The statistics show what a good business the Germans are doing with colonies other than their own—for example, with the Dutch East Indies.

March 11, 1904, should be a date to be long conspicuous in American engineering history, as on that day the first passage was made from shore to shore through the first tunnel under the Hudson River.

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Reform in the Teaching of Mathematics.

We have, from time to time, informed our readers of the public utterances of Prof. John Perry, of the Royal College of Science, London, in which, in somewhat iconoclastic language, he has arraigned the conventional methods of teaching mathematics, especially to engineering students, and at the same time has pointed out what he regards as a better way. The crusade which was inaugurated by Professor Perry is being taken up in this country, and, unlike the controversy in England, where its leader is primarily an engineer, it is here being led by professional mathematicians. Two papers have been read on this subject before American societies, the first by Professor Moore, of Chicago University, who made it the subject of his presidential address before the American Mathematical Society, and the second by Professor Waldo, of Purdue University, who made it the subject of his vice-presidential address before Section D of the American Association for the Advancement of Science.

The influence which has brought about the present agitation of the subject here as elsewhere is, however, that of engineers and engineering schools. Thus Professor Waldo says in his address:

"Our colleges to-day have seen a great light and have reformed their curricula. They now know there is no discipline in the pursuit of mathematics to the man who does not understand its language. Early in his course, if not throughout it, the student is allowed the more rational way of getting his education, by pursuing subjects that he *can* understand. This sensible treatment of educational material has grown up during the development of technical colleges and may be referred in a measure at least to their influence. Certainly great advance in the teaching of mathematics has recently been made, yet very much remains to be done, and the next great forward movement seems to be coming directly from the engineers and the forces they are setting in operation."

Just what the reform contemplates is well summed up in the following extract from Professor Waldo's address:

"Arithmetic, algebra, geometry and trigonometry will no longer be set off in 'water-tight compartments,' but will all be demanded in various combinations for the solution of single elementary problems. Squared and polar coordinate paper will represent the facts to the eye in geometrical symbolism and at the same time will give a practical introduction to the fundamental ideas of analytics and the calculus. By pursuing through the four years of secondary school life a carefully selected and properly graded problem course the pupil will review the whole range of elementary mathematical truth and become familiar with it, not only in theory, but also in practice. He will never be asking, 'What use?' But with the enthusiasm which original investigation only can arouse he will find his educational material in the simpler problems of the shop, the store, the farm, the bank, the railroad, the steamboat, the steam engine, the electric motor, political economy, geodesy, astronomy, time, space, force and so on through the range of the elementary aspects of the things of daily thought and experience in this complex and highly developed life of ours."

Again Professor Waldo thus states the demands of those who are furthering the reform:

"They insist upon quality rather than quantity.

"They insist that the problems shall be largely concrete and shall be worked out to an accurate numerical result.

"They insist that the thought shall precede the form and that the symbol shall not conceal the thing symbolized.

"They insist that systematic and progressive problems based upon every-day experience and observation shall be to a much greater extent the materials of education.

"They demand that the several elementary mathematical subjects from arithmetic to the calculus shall develop side by side in the boy's mind.

"They demand that the mastery of these subjects shall be more the work of the judgment than of the memory."

To these demands he might have added another which, as we understand him, forms a leading part in Professor Perry's program—the omission of what is useless that greater attention may be given to the useful. One has but to glance through an elementary algebra, for example, to be struck with the great amount of space that is devoted to subjects which are of no appreciable use either in applications to engineering problems or in later study of the subject of mathematics. The idea which seems to rule is that of giving a symmetrical development of the whole subject, carrying each phase of it to about the same point and regardless of whether the student will promptly forget some of those phases through disuse or not. There are some portions of algebra which are fundamental to all further study and to all applications of mathematics, while there are others which are fundamental to nothing and have so little application that their study represents a simple waste of time. It is Professor Perry's boast that by concentrating attention on the useful and by stimulating interest in it through the solution of concrete problems, his students really master the subject, by which he means that it becomes part of their mental make-up and its application becomes habitual after the manner of the multiplication table.

A World Combine of Steel Makers.

It is now reported that that which has long been predicted is about to take place so far as the principal steel industries of the world are concerned; the announce-

ment coming from Bremen to the effect that a prominent German paper states that the German steel trust which has recently been formed is beginning negotiations with the American steel trust and with the British steel manufacturing companies with a view to dividing the territory of the world and to the avoidance of competition within such divided territory. This, if there is anything in the report, is, we suppose, for the purpose of stopping the process known as "dumping" surplus products and avoiding "ruinous competition," but it is manifest that if successful it will place machinery interests and all other consumers of steel at the mercy of the world combine. This would be somewhat better than the present arrangement under which American machinery builders are at the mercy of the United States Steel Corporation and may find themselves competing for business abroad with foreign builders who buy American steel in their own country at lower prices than our own consumers can buy it for here.

Something of an innovation is seen in the fact that Arthur W. Holmes, second vice-president of the International Association of Machinists, residing in Toronto, recently addressed the class in political economy of the University of Syracuse on the subject of "Labor Union Organizations." Much might be said concerning this and much probably will be said regarding it, but if the knowledge of political economy is to be made at all practical or to apply to present-day conditions as they are, it is manifestly proper that students of that science should know something of labor union organizations and their ways, and of course it is no more than fair that the side of the labor unions should be stated by their own representatives. Little difficulty will be found in securing speakers to present the other side.

On the evening of March 14, at a meeting of the Manufacturers' Club of Cincinnati, Mr. Thomas P. Egan spoke on the subject of Reciprocity, telling how, as he expressed it, the United States was the "unfavored nation in France and Russia." He quoted figures to show the handicap under which the American machinery manufacturers suffered in these countries in attempting to do business, and advocated the appointment of a commission of business men to deal with this subject. It was decided to present the address of Mr. Egan at the next annual meeting of the National Association of Manufacturers.

Announcement is made that Andrew Carnegie has been elected a member of the Executive Committee of the Civic Federation to fill the vacancy created by the death of Mark Hanna. It is said that a particularly interesting incident of the meeting and dinner during which Mr. Carnegie was elected was his meeting with a labor leader who was prominent in the Homestead strike, and that Mr. Carnegie said that had he been in America at the time of the strike it would have not taken the course it did.

Some New Things.

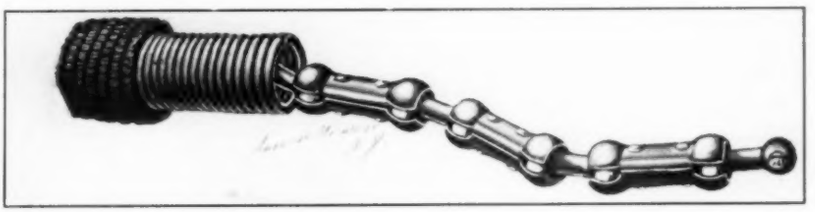
OPAQUE EDGE TRANSPARENT TRIANGLES.

The accompanying half-tone illustrates a new draftsman's triangle which is the product of Theodore Alteneder & Sons, of Philadelphia. The instrument is made of celluloid, and has a fine saw cut about 1-32 inch all around it, into which a black pigment is inserted which, of course, contrasts strongly with the drawing paper, and, by defining sharply the edge of the triangle, facilitates its use.

OPAQUE EDGE TRANSPARENT TRIANGLE.

FLEXIBLE SHAFT.

The flexible shaft shown herewith is designed for driving drills, grinders and other portable tools, and is of a unique construction, it being made up of a series of universal joints encased as indicated in tubing. Both ball and socket sections are of hardened steel, and the shells are formed in halves so that the parts are readily assembled or replaced at any time if necessary. It is made in several sizes and in lengths ranging from 5 to 8 feet, the different sizes as regularly constructed being capable of transmitting, at 1,000 revolutions per minute, from ¼ to 15 horse-power, though shafts for still heavier duty are also supplied where required. The Coates Clipper Manufacturing Company, Worcester, Mass., are the makers.

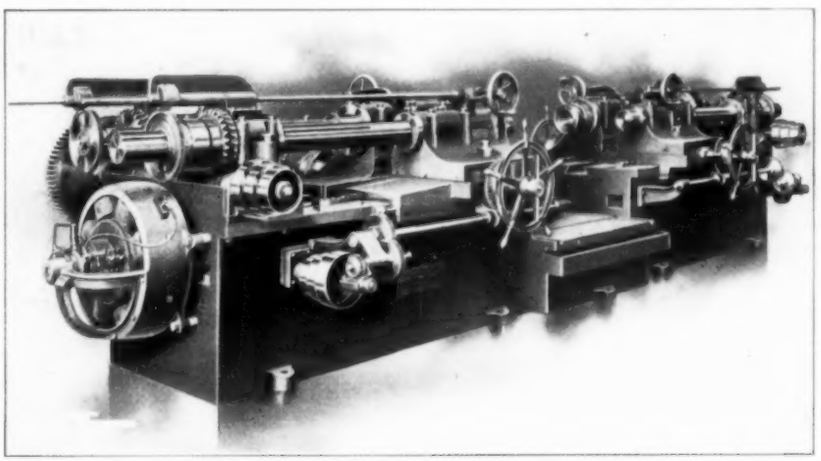


FLEXIBLE SHAFT.

FOUR-SPINDLE RAILWAY MOTOR BORING MACHINE.

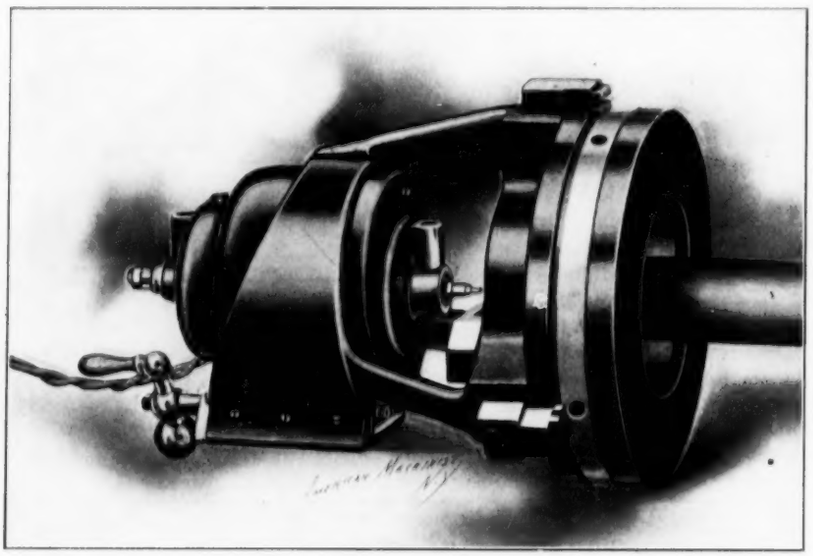
The machine shown in the accompanying half-tone was illustrated in these columns several years ago, when it first appeared, but recent improvements make it worth while to show it again.

The machine is for boring the four bearings of railway motors. Four spindles are provided—one for each hole to be bored—and, as will be seen, they are extremely heavy. The pair of spindles nearest the operator's side of the machine are adjustable in distance from the rear pair in order to accommodate different sizes of motors. The spindles are operated by steep pitch worms driven by the motor shown in the foreground and connected to the spindles by clutches operated by conveniently placed hand wheels.



RAILWAY MOTOR BORING MACHINE.

When boring the bearings each spindle carries its own tool by the thread upon its end, but the farther rear spindle will be seen to be hollow, the purpose of this arrangement being to permit the use of two spindles in connection with a boring bar for boring the pole pieces of the motor. This bar need be driven by one spindle only, but the opposite one gives additional needed support. By revolving both spindles, although but one drives the bar, wear in the hole of the supporting spindle hole is avoided.



PORTABLE CENTERING MACHINE.

A PORTABLE CENTERING MACHINE.

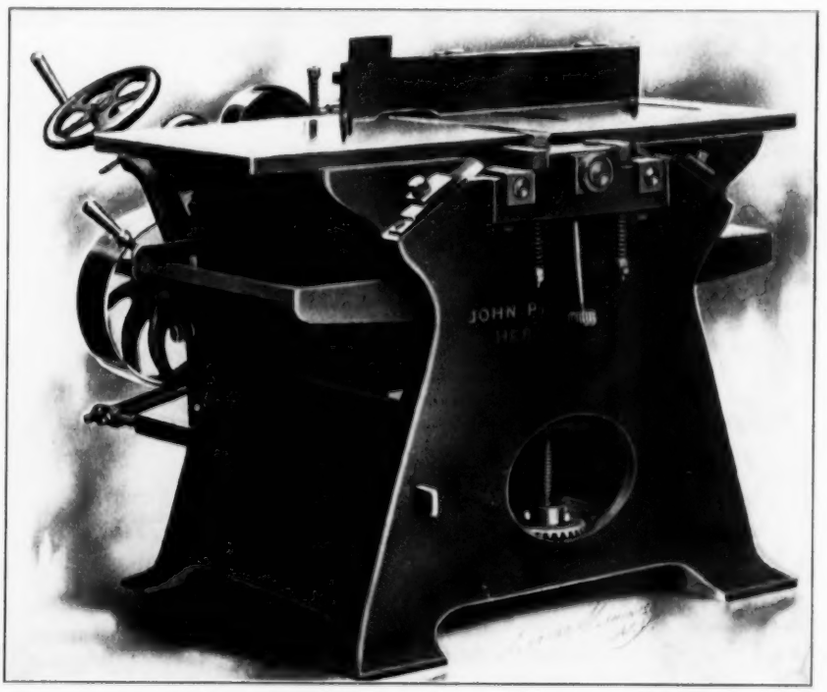
The accompanying illustration shows a new and obviously useful centering machine for use on bars which are of such size and weight as to make it inconvenient or impossible to center them on the usual stationary machine.

The machine, of which the illustration is almost self-explanatory, consists of a universal chuck to which is attached a small electric motor by means of a frame which, for reduced weight, is made of aluminum composition. The motor shaft carries a drill and countersink and a slide and feed screw feed the motor and drill to the work. A bar is bolted across the inside of the chuck just below the drill and acts as a stop to prevent the insertion of the bar too far and hence to protect the drill from possible damage.

The machine shown has a length of 10 inches, a diameter outside the chuck of 8 inches and a weight of about 25 pounds. The machine is the invention of Frank H. Hudson, of 110 State street, Boston, Mass.

A DOUBLE SERVICE WOOD PLANER.

The half-tone shows an interesting machine which should be of great usefulness in pattern shops, etc. Material may first be surfaced upon the upper table and then passed back on the lower table and under the cutters to be planed to any required thickness. For the lower table a power feed is provided, and the table may be angled slightly so that stuff can be planed taper to give draft, as generally required in a pattern for molding. Pressure bars are provided close to the cutters, so that long or short lengths and the thinnest stuff can be planed. The working side of the machine is free from gearing or belts. The cutter runs at 4,000 revolutions, and the feed is about 30 feet per minute. The machine is made in several sizes to plane from 16 to 30 inches wide, each size taking 9 inches in depth. The makers are John Pickles & Son, Herben Bridge, Manchester, England.



A DOUBLE SERVICE WOOD PLANER.

MOTOR-DRIVEN RADIAL DRILL WITH SPEED BOX.

The engravings illustrate a 60-inch radial drill driven by a constant-speed motor and equipped with a speed-varying gear through which a wide range of spindle speeds is obtained. The cylindrical column of this machine swings on a central post fixed to the base and reaching almost to the top of the column. The clamping is done by a split band encircling a shoulder on the fixed post and a flange at the lower end of the column turned to the same diameter. Power is transmitted from the motor by pitch chain to the driving shaft in the gear box, the latter having two shafts with seven gears on each, proportioned for seven speeds in geometrical progression. The gears are arranged as indicated in the sketch, Fig. 2, and they are all fixed to their shafts, except the largest one on the variable-speed shaft, which is connected by a pawl and ratchet arrangement. Connection between this ratchet gear and the smallest gear on the driving or constant-speed shaft is formed by an intermediate pinion through which the driven shaft is operated at its slowest rate of speed. When the velocity of the variable-speed shaft is increased, the ratchet fixed on this shaft runs ahead of the pawl carried by the loose gear. The lever projecting at the front of the gear box carries an intermediate for connecting different pairs of gears on the two shafts, and may be shifted sidewise to bring this gear over any desired pair. A locking plate, drilled as shown is fitted to the front of the casing, and when the lever with its intermediate is correctly positioned, the latch and plunger below the handle lock it vertically and the vertical pin horizontally. Although the gearing never has to be brought from a state of rest to high speed, as the variable-speed shaft runs always at the slowest speed, to avoid

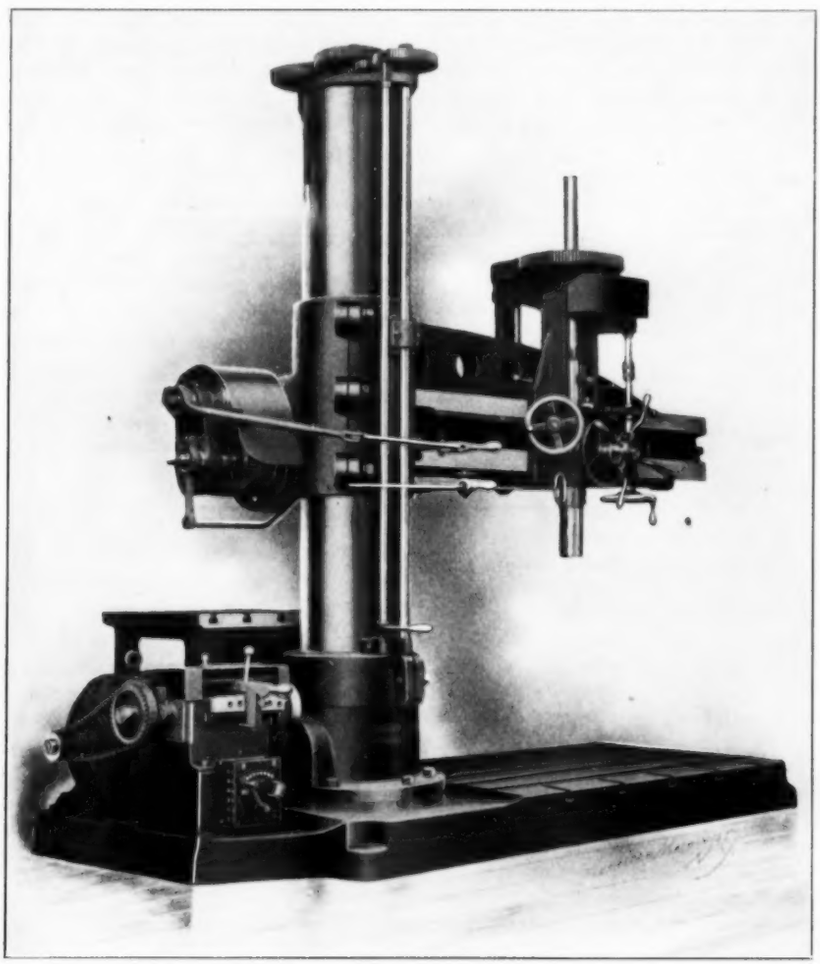


FIG. 1. RADIAL DRILL.

all possibility of shock in shifting from low to high speeds a frictional connection is introduced between the spindle-driving shaft and the driven shaft in the box.

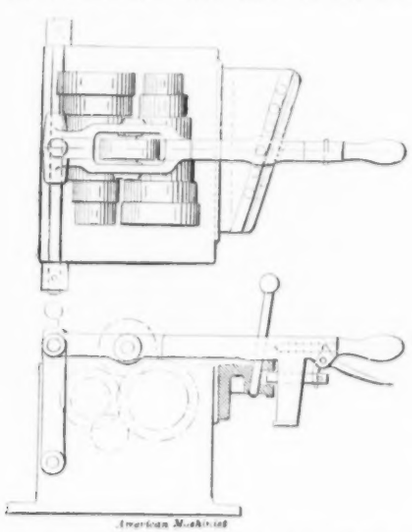
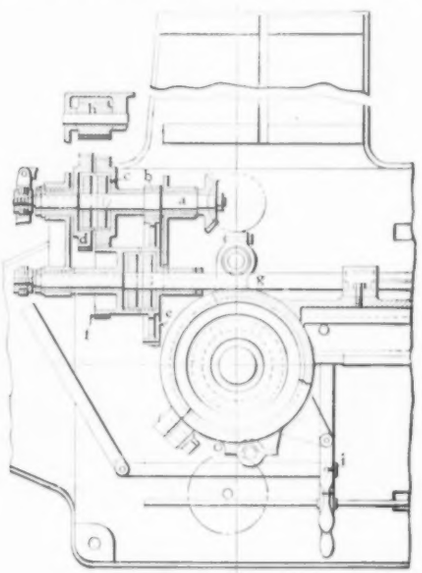


FIG. 2. ARRANGEMENT OF GEARING IN SPEED BOX.

This friction is similar to a planer feed friction, and is adjusted to carry the heaviest load of the drill, but slips when taxed beyond this. Motion from the gear box to the spindle is transmitted in the usual way by the horizontal shaft near the base, a pair of miter gears and central shaft in the column, two spur gears at the top of the column and an outside vertical shaft carrying a sliding miter gear. This gear engages with another on a short shaft *a*, Fig. 3, having fixed on it the pinion *b*, and carrying loosely the two friction gears *c* and *d*. Pinion *b* meshes with friction gear *c*, and *c* with friction gear *f* on shaft *g*. Friction gear *d* engages indirectly with *f* by means of the intermediate pinion *h* journaled in the gear casing. The lever combination *i* operates the double friction in gears *e* and *f*, and, engaging one or the other, changes the speed according to the ratio of the gears. The double friction between gears *c* and *d* is operated by the lever *j*, and, if engaged with *c*, causes the spindle to run forward rapidly; if engaged with *d* the spindle is driven backward and still faster in accordance with the different diameters of the two gears *c* and *d*. It is obvious that by clutching *d* to shaft *a* slow forward and rapid reverse speeds are obtained by engaging the lower friction with



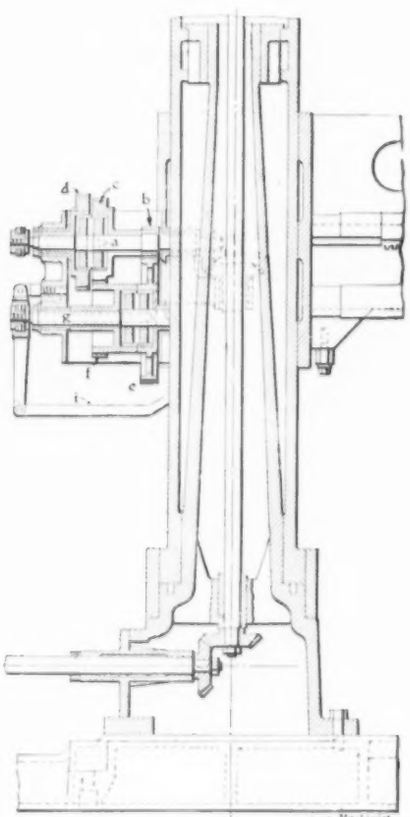


FIG. 3. SHOWING GEARING ON COLUMN.

e and *f* alternatively. By clutching *f* to *g* and operating the friction between *c* and *d* a fast forward and slightly increased reverse speed of the spindle may be brought about. The power feed for the drill spindle is of the geared type. It has six changes and is varied by shifting a knurled knob on the feed rod, the latter engaging, through the medium of a feather, the required gear in the nest above. The machine is built by the Dreses Machine Tool Company, Cincinnati, Ohio.

CRANK SHAPER WITH SPEED BOX.

The illustrations show a crank shaper equipped with a novel and interesting speed box which gives, in connection with back gears, eight rates of speed for the ram, the drive being obtained through the medium of a single belt operating on plain fast and loose pulleys mounted on the end of the main or driving shaft. These pulleys do not appear in the half-tone, as they are located at the rear of the column, and in the line cut which gives the general arrangement of the speed box the main shafts are broken off just inside the column wall.

In the latter engraving the shaft driven direct or through back gears, from the pulleys noted, is shown at *a*. As will be seen, this shaft carries at *b* a long pinion. At *c* is a nest of spur gears secured on the pinion shaft *d*, through which the ram-reciprocating mechanism is actuated. Though six gears will be noticed in this bank in the drawing, it is understood that there are but four in the actual gearbox. Carried by a rotating frame *e* and meshing with pinion *b* are idler gears, which, as *e* is turned through pinion and gear actuated by means of crank-handle *f*, mesh one after another with their mating gears in cone *c*, thus giving for each gear so engaged a different rate of speed to shaft *d*.

One turn of crank *f* suffices to swing

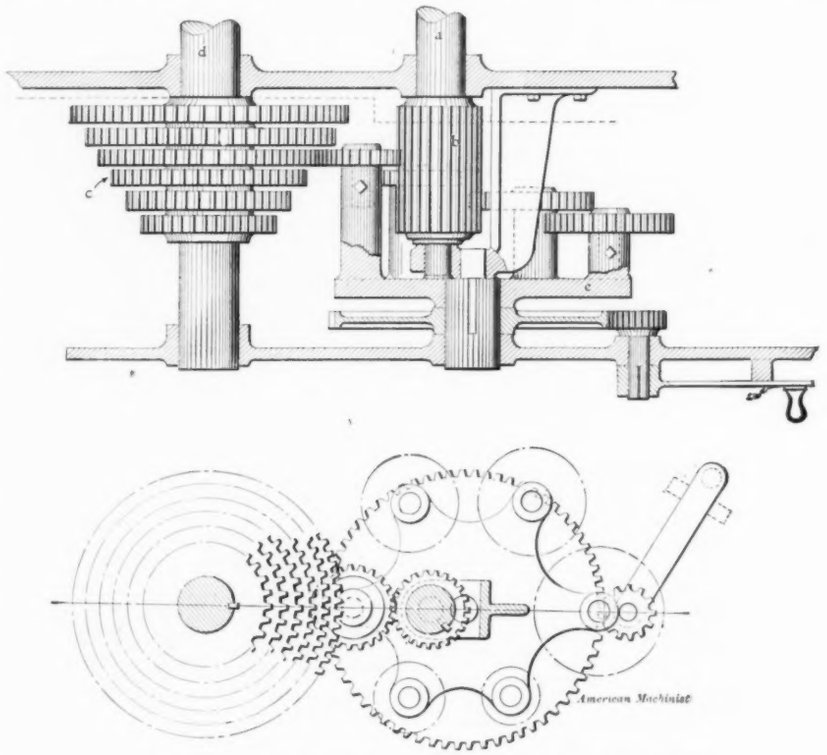


FIG. 2. GENERAL ARRANGEMENT OF SPEED BOX MECHANISM.

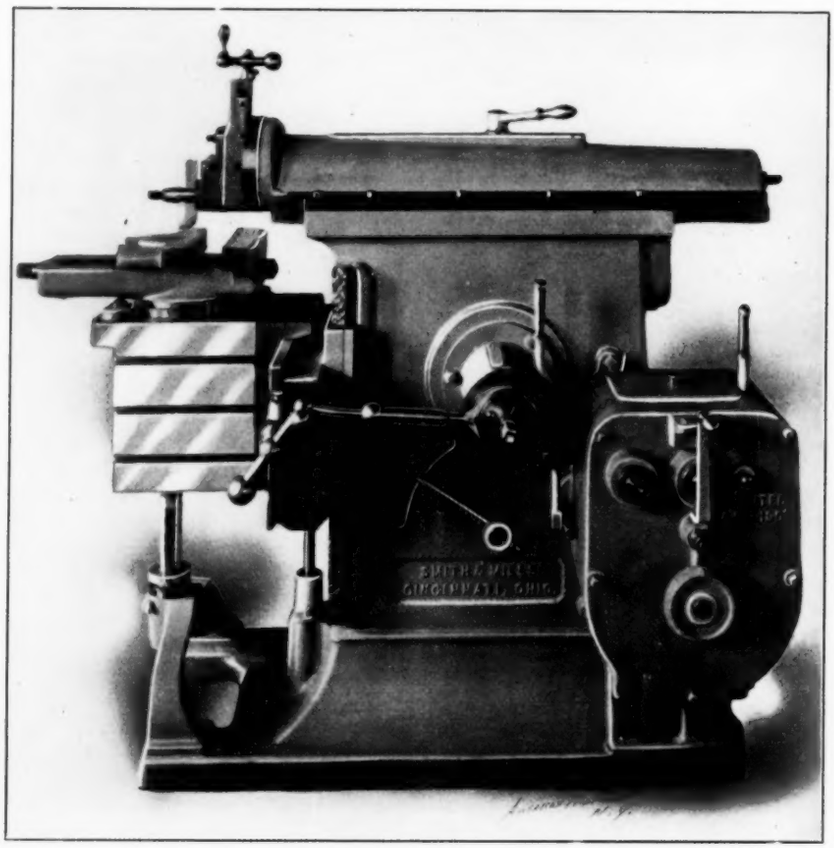


FIG. 1. CRANK SHAPER WITH SPEED BOX.

one idler out of mesh with its mate and throw the next into action. Hence it is an easy matter for the operator to change the speed even with the machine in motion, as he has only to spring the crank out of a notch which serves to lock it fast in the position indicated in the half-tone, and revolve it until the required intermediate is engaged with the gear cone, when the handle is again locked fast by dropping into the notch. The position of the intermediates or idlers is revealed to the observer by an indicator rotating in unison with the crank.

The back gears are engaged or disengaged by means of the lever extending upward through the slot in the top of the gearbox; the machine is stopped by the lever to the left of the box. It is obvious that this speed box can be readily connected to and operated by a constant-speed motor, if desired, in place of the belt drive.

The shaper illustrated is a 20-inch tool and one of a line of similar machines having strokes ranging from 12 to 24 inches. The base, it will be noticed, is extended at the front and carries an outboard support for the knee. The stroke may be varied at will with the machine in motion, and a locking device for the operating pin positively prevents it changing when the ram is in action. The length of the stroke is shown by an indicator arm at the side of

the column. The feed rod is reciprocated by an adjustable eccentric plate. The swiveling vise is graduated in degrees, and both vertical and cross feed screws are provided with micrometer dials for facilitating rack-cutting and other operations. An opening under the ram admits shafts of any length for keyseating.

Smith & Mills, of Cincinnati, Ohio, are the builders of this tool.

A Union Engineering Building in New York.*

New York city, already adorned with some fine buildings devoted to the arts and sciences, is now to enjoy the possession of a great central home for engineering, due, very appropriately, to the initiative and generosity of Mr. Andrew Carnegie, and carrying out ideas with which the public has become more or less familiar during the past year. The following letter gives the facts briefly:

Andrew Carnegie, 2 East 91st St., New York, March 14, 1904.

Gentlemen of the Mechanical Engineers; Institute of Mining Engineers; Institute of Electrical Engineers; Engineers' Club of New York:

It will give me great pleasure to devote, say, one and a half million of dollars for the erection of a suitable Union Home for you all in New York city. With best wishes, truly yours,

(Signed) ANDREW CARNEGIE.

It may be stated that the three national engineering societies named and the Engineers' Club, which, by reason of its widespread membership, is also increasingly national in character, have, with the unanimous approval of all the memberships, already taken active steps to put into being the splendid trust for engineering thus created by a man whose own career has illustrated the upgrowth of the engineering and industrial arts in America. The total amount involved is not less than $2,500,000, for, in addition to the amount given by Mr. Carnegie, a sum of over $500,000 represents the investment in land for the three societies on West Thirty-ninth street, between Fifth and Sixth avenues; while the Engineers' Club has also acquired valuable land for its own purposes on West Fortieth street, immediately facing the New York Public Library. The Union Engineering Building will probably be twelve stories in hight, and will be laid out expressly with an eye to the services required of it. In many respects it will be unique. The three national engineering societies made trustees by Mr. Carnegie will have large headquarters there; and already several kindred bodies have made urgent requests for accommodation. There will be four or five auditoriums of different size, notably one to seat 1,200 to 1,500 persons; and all will be appropriately equipped for scientific meetings, lectures and demonstrations. Above all, there will be an engineering museum and a noble library hall, where all the libraries concerned will be grouped and consolidated, yet each section administered by its respective society librarian and each adding to its own specific literature, so as to avoid duplication of outlay for books or periodicals. It is proposed, moreover, to co-operate intimately with the New York Public Library, nearby, along these lines of work, so that nowhere else in the world can the student or practitioner find thus freely available the whole literature of engineering and technical industry. The three libraries assembled in this manner will even at the outset include some 50,000 volumes, many of them great rarities of inestimable price.

The three societies, each of course maintaining its identity and autonomy, will themselves need considerable room in the new building, which it is hoped to have ready in 1906. They have a total membership to-day of over 9,000, and are growing at a rate of between 10 and 15 per cent. annually. They administer a total income of $135,000 annually, and in assets of all kinds have property to the value of between $250,000 and $300,000, a sum to which the gifts of individual members are now adding rapidly. The sister technical societies asking for quarters and facilities represent also another great body of over 5,000 members, engaged in all branches of civil, mechanical, electrical, municipal engineering, etc. Large, therefore, as the Union Engineering Building, with its frontage of 125 feet on five lots, may seem, it bids fair from the start to find every inch put to fructifying use. The Engineers' Club Building, a separate entity, will immediately flank the Union Building, the two sharing the same resources of light, heat and power, and being most advantageously situated for intercommunication and mutual social benefit. The club, with a long waiting list, has just increased its membership to 1,200, and administers a budget of about $120,000 a year. The buildings, facing thus on two streets, are to harmonize as to architecture, as they do virtually in function, as homes of engineering, and their central position commanding all lines of travel at the very heart of the city, insures the acme of convenience to visitors from outside the city or from abroad, as well as to all local members.

The three societies provide the land; but in the meantime Mr. Carnegie has promptly acquired it for them. The leases run out about July 1 and work will then begin forthwith and be pushed ceaselessly to completion, as the building is in reality sorely needed by the bodies that are to occupy it, and that now chiefly occupy rented quarters ill-suited to their purposes. The Engineers' Club has also already made purchases of land for itself on West Fortieth street, not far from the new Republican Club, opened recently. Plans for the architectural part of the undertaking have already been drafted, and the architects will soon be selected. The representatives of the four bodies interested as the direct beneficiaries and trustees of Mr. Carnegie's splendid gift to engineering are as follows: American Society of Mechanical Engineers—Prof. F. R. Hutton, C. Wallace Hunt, J. M. Dodge. American Institute of Mining Engineers—Dr. A. R. Ledoux, Theodore Dwight, C. Kirchhoff. American Institute of Electrical Engineers—C. F. Scott, Dr. S. S. Wheeler, Bion J. Arnold. The Engineers' Club—J. C. Kafer, W. H. Fletcher, T. C. Martin. These as a conference committee have carried the matter patiently through its earlier stages and are now vigorously engaged in working out all the details of an enterprise which, recognizing frankly the close interdependence of all branches of engineering, endows them jointly with means for professional and educational work never before enjoyed in any country by such organizations, or on such broad conditions of public welfare; leaving, nevertheless, to the societies their distinctive and individual conditions of existence.

*Official statement given out by the committee and published by request.

The Chicago Meeting of the Mechanical Engineers.

The following embodies the official preliminary notice of the Chicago meeting of the Mechanical Engineers. This is the regular spring meeting of the American Society, beginning on the evening of Tuesday, May 31, and ending probably on Friday, June 3:

The meeting is to be a joint session of the American Society of Mechanical Engineers and the Institution of Mechanical Engineers of Great Britain. This latter body holds an American meeting this spring, and by invitation of the Council makes its American meeting a joint session with the society at its Chicago meeting. Nearly 200 members of the British Institution have expressed their intention of coming to America and taking part in this joint meeting. It is the purpose of th se visitors not only to attend an American meeting and thereafter visit the St. Louis Exposition, but to make the American visit the occasion of excursions to points of technical and manufacturing interest all through the United States.

Among the subjects of papers to be presented at the Chicago meeting by the British Institution will be "The Steam Turbine," "The Gas Engine," "Motor Cars," Hydraulic and Electric Cranes," "Induction Fans and Garbage Destructors." The Committee on Meetings has decided to ask for papers on "The American Steam Turbine," "The American Gas Engine," "The Power Plant of the Tall Office Building," "The American Locomotive Testing Plant," "The American Shop Management Problem," "The Modern American Machine Tool" and one or two

others. Pursuant to this policy it will not ask for contributed papers from the members on any other subjects than these, with a view of limiting the number of papers to be read and giving the greatest available time for extended discussion. It is hoped that the papers from the British Society may be distributed with the American papers to members of the society.

Improving Machinery Outlook.

The following we take from the *Journal of Commerce and Commercial Bulletin* (New York) of March 21:

A revival in the machinery industry seems to be following in the wake of the increased activity in iron and steel products. The placing of the general contract for the tunnels to be driven under the North and East rivers and Manhattan Island is to be followed by sub-contracts for iron and steel castings, cement and other supplies, while the power houses which are to be constructed at both the New Jersey and Long Island shafts will require the placing of orders for boilers, air compressors, hydraulic machinery, dynamos, engines, etc. It is estimated that specifications, which will soon be issued for a portion of the machinery required, will require the expenditure in the neighborhood of $2,000,000 for both the North and East river sections of the work.

Specifications were issued early last week for 52,000 tons of iron castings required for preliminary work in the construction of the North River section. This will be the first tunnel sub-contract and will be awarded probably the latter part of this week. Tenders have been received from nearly all of the principal Eastern foundries, and even those not so advantageously situated to make deliveries are competing actively for the work.

Several of the large orders for machine tools which have been on the market for several weeks have been closed, among them being the General Electric Company's contract for boring mills to be installed in the Schenectady plant. This contract was awarded to the Niles-Bement-Pond Company and in round figures involves about $145,000.

The Power & Mining Machinery Company also has awarded contracts for $80,000 worth of machine tools, including planers, drills, shapers, millers, boring machines and lathes for installation at the plant at Cudahy, Wis.

One of the most encouraging features to the machinery trade, as well as to structural mills, is the bringing out of specifications for extensions of existing industrial plants, and even for a number of new works which will require the purchase not only of structural steel but of power equipment, both steam and electrically driven, including engines, dynamos, motors, boilers and also machine tools. These inquiries are coming from various sections of the country, but largely from the East. One of the new local industries projected is the Metropolitan Sugar Refining Company, which will build a plant at Weehawken, N. J.

The Metric System Before Congress.

At the hearing of the House Committee on Coinage, Weights and Measures, held March 17, Professors John E. Sweet and William Kent and Mr. W. M. McFarland, of the Westinghouse Electric & Manufacturing Company, made protests against the passage of the pending bill.

It is announced that the plans for the model foundry at the St. Louis Exposition are completed and that the construction of the building will soon be commenced. The entire charge of this foundry will be in the hands of the Worcester Polytechnic Institute.

The American Tool Works Company, of Cincinnati, have, through purchase, acquired manufacturing rights under the several patents which have been issued pertaining to gear-changing devices. This gives them the undisputed right to build their improved "American" engine lathe with quick-changing mechanism for thread cutting and feeding.

Those of our readers who may have been interested in the articles describing the Interferometer of Professor Michelson, of Chicago, and his apparatus for extremely minute measurement by means of wave lengths of light will be glad to know that the University of Chicago Press has published a book by Professor Michelson entitled "Light Waves and Their Uses," which book is likely to be extremely interesting to those who have an ambition to know something of how the most exceedingly refined work in measurement is done.

One of the most interesting features of the new plant now being erected by the B. F. Sturtevant Company, at Hyde Park, Mass., is an elaborate testing plate for engines. The plate, or more properly the plates, will be supported upon a series of heavy parallel walls, between which steam and exhaust pipes are carried, so that at almost any point in the entire area of the floor, measuring about 30x60 feet, steam and exhaust connections may be made to any engine. Testing facilities will be provided, and a transfer crane overhead will make it very simple to locate or remove the engines. The same crane will transport them to the packing department, and thence load them directly upon cars which traverse the end of the building.

Personal.

Charles H. Haswell, the first Chief Engineer of the United States Navy, best known to the present generation through his "Mechanics' and Engineers' Pocket Book," has just passed his ninety-sixth birthday and is in his usual vigorous health. He is at present assistant engineer to the Board of Estimate and Apportionment of New York city.

The Lagonda Manufacturing Company, of Springfield, Ohio, will on April 1 open an office in Pittsburg at 112 Wood street. Robert Gregory will be in charge as manager.

Alonzo G. Collins, who has for some years been chief draftsman for the Rarig Engineering Company, Columbus, Ohio, has severed his connection with that company. His plans for the future are not yet fully matured.

Science announces that Section D (Mechanical Engineering) of the American Association for the Advancement of Science has chosen Prof. David S. Jacobus, of Stevens Institute, Hoboken, N. J., as its vice-president for the present year.

Frank H. Fowler, who has been identified with the Knox Automobile Company, of Springfield, Mass., for several years, has associated himself with the Matheson Motor Car Company, of Grand Rapids, Mich., as head salesman.

S. D. V. Burr, who for many years was mechanical editor of the *Iron Age*, has retired from that position and now has an office at 113 Liberty street, New York, where he prepares descriptions of engineering constructions, catalogs, and makes photographs of machinery, etc.

Hermon B. Butler, late vice-president and treasurer of Joseph T. Ryerson & Son, iron and steel merchants, Chicago, left a will disposing of $610,000 personal property. The will reads as follows: "This is my last will. I give all my property to my wife, whom I appoint sole executrix."

Obituary.

George Henry Firth, superintendent of the Firth-Sterling Steel Company, Demmler, Pa., a branch of the Thomas Firth & Sons Steel Company, of Sheffield, England, died at Pittsburg, March 14, forty-seven years old. Mr. Firth was a son of Thomas Firth and a descendant of one of the oldest commercial families of England.

Charles B. Magruder died on March 9 in Cleveland, Ohio, aged twenty-five. He was a graduate of the Williamson School, Pennsylvania, and during the session of 1902-3 he taught shopwork at the McDonogh School, Maryland. He was much interested in preparing himself for teaching manual training in a college in a thoroughly practical way, and as a means to this end had worked in a number of machine shops. He was the author of the excellent article at page 219 on "Laboratory vs. Shop."

Business Items.

The Rochester Gas Engine Company, of Rochester, N. Y., has been reorganized, with the following officers: President, J. S. Graham; vice-president, J. J. Leary; secre-

tary and treasurer, W. J. Graham. Increased facilities for the building of marine, stationary and automobile engines in large quantities have been completed.

Two recent orders received by the Hartford Blower Company, of Hartford, Conn., were from the Oak Duke Lumber Company, Wellsville, N. Y., and the Pennsylvania Match Company, Bellefonte, Pa. These orders are for the Hartford exhaust systems for removing the shavings, sawdust, chips, etc., from wood-working machinery.

Manufacturers.

Looms and more spindles will be put in the Franklin Mills, Greers, S. C.

The Humboldt (Tenn.) Hoop & Heading Company's mill has been burned.

Crow Bros., Monroe, N. C., are organizing a company to manufacture hosiery.

The Maritime Nail Company, Ltd.'s, works at St. John, N. B., have been burned.

Beech Bros., address not stated, propose to build a foundry at Charlotte, Mich.

The directors of the Humboldt (Tenn.) Cotton Mills propose to double the capacity.

The El Paso (Tex.) Foundry & Machine Company has been enlarging its foundry.

A permit for an addition has been issued to the Bridgeport (Conn.) Brass Company.

A lumber mill and dry-house owned by C. V. Starbird, Strong, Me., have been burned.

Hay Brothers, of Cannelton, Ind., will establish a pearl button factory at that place.

The Kimball Foundry Company, Oklahoma, Okla., is putting up an artificial stone building.

A plant of the Sanitary Laundry Machine Company, Tell City, Ind., is nearing completion.

An addition is about to be built to the Oneida (N. Y.) Steel Pulley Company's factory.

Galesburg, Ill., is trying to get the Chicago (Ill.) Writing Machine Company to come there.

At Doylestown, Pa., the Worstall & Carl Spoke & Wheel Company's plant has been burned.

The National Carbon Company, Cleveland, O., will construct a plant at a cost of about $200,000.

The A. H. Pugh Printing Company, Cincinnati, O., has had plans made for a very large plant.

The Hughes Eyelet Company, Taunton, Mass., has let contracts to build a 50x120-foot factory.

Additions to the plant of Fels & Co., manufacturers of soap, Philadelphia, are being planned for.

The planing mill and two dry-houses of the Berlin Mills Company, Portland, Me., have been burned.

John Morrell & Co., Ltd., Ottumwa, Ia., will erect a refrigerating plant at their meat packing house.

A good-sized flouring mill is proposed for Denton, Tex., by F. M. Rayzor, George T. Cobbs and others.

The plant of the York Haven (Pa.) Water & Power Company is understood to have been demolished by ice.

The Bradford Pressed Brick Company is arranging to enlarge its plant at Lewis Run, near Bradford, Pa.

The contract has been let to build a new plant for the Century Furniture Company, Jamestown, N. Y.

A large factory building is being erected for E. Teel & Co., manufacturers of carriages, etc., Medford, Mass.

The West Chester (Pa.) Gas Company will build a new gas purifying house and make various betterments.

The State Line Company, lumber, proposes to erect a big plant at Newport, Wash., and perhaps other plants.

Chain works at Carlisle, Pa., belonging to Standard Chain Company, of Pittsburg, have been damaged by fire.

Chas. Owens and E. F. Williams will build a foundry at Sterling, Ill., to be called the Twin City Job Foundry.

An addition is projected for the plant of the Essex Paper Company, manufacturing stationer, Holyoke, Mass.

The Oatka Gypsum Mining Company, lessee of property at Le Roy, N. Y., may later establish a plaster of paris plant.

A new factory building is to be erected for Schubert Bros.' Gear Company, Oneida, N. Y., manufacturer of wagons, etc.

A new core shop will be built for the plant of the Michigan Brass & Iron Works (C. W. Thomas, proprietor), Detroit, Mich.

C. B. Vance, J. C. Price and A. L. Jagoe, all citizens of Batesville, La., propose to organize a spoke factory at Pittsboro.

The Harrison Machine Works, Belleville, Ill., manufacturers of threshers and engines, expect to build a new and improved plant.

The W. R. White Company, Bloomington, Ill., manufacturer of gates and elevators, has bought land adapted for building purposes.

A three-story factory building, 50x85 feet, is about being erected for the Chloride of Silver Dry Cell Battery Company, Baltimore, Md.

It is rumored that a consolidated powerhouse of the Cincinnati, Dayton & Toledo Traction Company is to be erected at Hamilton.

A building permit has been granted for eight buildings to replace the burned plant of the Johnson Forge Company, Wilmington, Del.

Estimates were recently being received on a boiler and engine house for Morse, Williams & Co., manufacturers of elevators, Philadelphia.

Beebe & Saunders, of Hamilton, N. Y., are locating a plant for the manufacture of the Curtis ball bearing cow stanchion in Randallsville.

The Packer Manufacturing Company, New York city, soap manufacturer, proposes to build a factory at Mystic or Stonington, Conn.

The Philip Carey Manufacturing Company, of Lockland, O., and elsewhere, asbestos materials, will erect another shop, 300x90 feet in size.

The Standard Oil Company, it is said, is planning to build a large refinery near Kansas City for making a variety of petroleum products.

The Eastern Steel Company, operating mills at Pottsville, Pa., will erect a bridge works on Pioneer Island, the site of the old Atkins furnaces.

The Erie City Iron Works, manufacturers of engines and boilers, Erie, Pa., are planning to erect additions and extensions to cost about $160,000.

The Meridian (Miss.) Fertilizer Factory proposes to double the capacity of its plant within a few months, involving an expenditure of $125,000.

The Imperial Knitting Company, newly incorporated, with a capital of $200,000, will erect a mill at Scranton, Pa., to manufacture cotton underwear.

Estimates have been taken on an additional story, 48x200 feet, to a factory of Thomas Wolstenholme Sons & Co., worsted yarns, Philadelphia, Pa.

The Haskell & Barker Car Company, of Michigan City, Ind., proposes the erection of a steel plant to employ 500 men, making a total force of 2,500.

The Barber Asphalt Paving Company, Philadelphia, New York, etc., proposes this season largely to increase the output of its Des Moines (Ia.) plant.

The J. S. Kemp Manufacturing Company, manufacturer of manure spreaders, Newark Valley, N. Y., is understood to be erecting another foundry building.

Estimates are being taken on an erecting and machine shop, about 200x200 feet, for the Olean shops of the B. & A. V. division of the Pennsylvania Railroad.

Work is about starting on a three-story building, 80x240 feet, at Greenville, Mich., for Skinner & Steenman, manufacturers of furniture, Grand Rapids, Mich.

It is reported that Charles King & Son, of Alexandria, Va., will erect a large canning factory near Templemans, in Westmoreland County, for canning tomatoes.

Bids have been asked by the Business Men's Association, Hannibal, Mo., for the proposed Star shoe factory, through Ernest Schmidt, architect, 118 North Third street.

The Paragon Plaster Company, of Syracuse, N. Y., has purchased patent right from the American Hydraulic Stone Company, and will build a concrete block factory.

The Columbia Foundry Company is locating at New Richmond, O., where it expects to have a foundry building, 80x125 feet, with boiler-room, to be ready about May 1.

Walborn & Riker, manufacturers of pony and light horse vehicles, St. Paris, O., are incorporating and propose to enlarge their capacity to three times its present size.

It is stated at Baltimore, Md., that Levinson & Zenit have let the contract for the erection of a 38x40-foot, three-story building for the manufacture of furniture.

Muntz & Jung is the name of a new firm in Elgin, Ill., which will establish a factory for the manufacture of dairy supplies, such as milk cans, pails, strainers and churns.

John H. McDowell, Syracuse, N. Y., has some thought of erecting a building to rent out in manufacturing quarters. It may or may not be equipped with a power plant.

Ground has been purchased for the enlargement of the cold-storage plant at El Paso, Tex., of Swift & Co., Chicago. It is not certain when the enlargement will be made.

The directors of the Holyoke (Mass.) Water-Power Company met in Hartford, Conn., lately, when a report was made on the proposed new electrical generating plant.

Work has begun on a one- and two-story addition, 60x27 feet, to the machine shop and stable of the Pennypack Yarn Finishing Company, of Holmesburg, a suburb of Philadelphia.

The Mancha Show Case Company is being organized at Grand Rapids, Mich., by Raymond Mancha, and work is about starting on a factory to contain 60,000 square feet of floor space.

The Aultman & Taylor Machinery Company, Mansfield, O., contemplates new buildings and additions. It has under construction a structure, 60x76 feet, to be used as a testing room for separators.

The Memphis (Tenn.) Bridge Company (capital, $50,000) is breaking ground for a structural iron and steel plant. Col. I. F. Peters, of the Industrial League, is acquainted with the matter.

B. J. Sloan, of Waynesville, N. C., is heading an enterprise for the proposed develop-

ment of 1,500 water horse-power. The survey work is in the hands of J. J. Dalton, civil engineer, Asheville.

A boiler in the T. L. Knudtson Machinery Manufacturing Company's plant, Chicago, exploded, March 15, seriously injuring two men, shattering one side of the building and starting a disastrous fire.

The Belmont Iron Works have purchased, it is reported, part of the Gruson Iron Company's tract, at Eddystone, Pa., and will erect a plant there in conjunction with their works in West Philadelphia.

The Ferracute Machine Company, presses, dies, etc., Bridgeton, N. J., has broken ground for its new machine shop, 100x200 feet. This does not include the power-house, carpenter shop, pattern shop or storage room.

The Chicago (Ill.) Tie Preserving Company will erect a branch plant at Terre Haute, Ind. It will include a steel tank, 6 feet in diameter and 126 feet long, known as a "retort," with boilers, engines, etc.

A foundry and machine shop, employing 100 men, will be built in the East End of York, Pa., by the York Foundry & Machine Company. The projectors are Israel Loucks, S. Forry Loucks and J. A. Dempwolf.

M. H. Ward, of the Thatcher Medicine Company, Chattanooga, Tenn., and others may form a company with about $25,000 capitalization and build an ice plant. It will probably not be ready for this season.

J. J. Littlejohn and D. D. Little will organize a company, with capital of $32,000, to establish a knitting mill. Littlejohn is president of a knitting mill at Jonesville, S. C., and Little a cotton dealer in Spartanburg, S. C.

Wilson Bros., of Sibley, Ia., have purchased the brick and tile factory of C. Quasdorf, of Dows, Ia. It is their intention to make the plant larger, and there is talk of putting in an electric light plant for the village in connection.

The Peerless Motor Company, manufacturer of gas and gasoline engines, etc., Lansing, Mich., is said to intend the erection of a new factory, with a foundry in connection. The plans were not, at the time of the report, ready for discussion.

W. H. Hanna, of Chicago, has been at Terre Haute, Ind., promoting the Mutual Heating Plant, which proposes to heat residences and business houses by means of a central station. W. H. Schott, heating engineer, of Chicago, was also expected.

It is stated at New Castle, Ind., that the Gronendyke washing machine factory, north of Honey Creek (village?), has been purchased by Middletown men and will be moved there. Adolph Cooper and John Burke will have charge of the business.

It is stated at Baltimore, Md., that plans have been prepared at the office of the chief engineer of the Northern Central Railway for a power-house and boiler-room to be built at the Mount Vernon freight yards. The former will be 39x69.6 feet and the latter 52x28 feet.

Plans are being prepared by the George M. Newhall Engineering Company, of Philadelphia, for a large sugar refinery to be erected at Weehawken, N. J., for the Metropolitan Sugar Refining Company, evidently the concern whose formation was recently reported in this paper.

The F. W. Devoe & C. T. Raynolds Company, manufacturer of paints, etc., with offices in New York city, has bought a tract of property in Brooklyn, to replace the factory which was burned recently. The property includes buildings equipped with engines, boilers, elevators, etc.

The Western Telephone Manufacturing Company, Chicago, Ill., has announced the removal of its factory from Winthrop Harbor, Ill., to Chicago, where it was to be in operation by March 15. The company's mail and merchandise address is 42 West Jackson Boulevard, Chicago.

The Illinois Milling & Elevator Company, Tamms, Ill., has been formed, the incorporators including Oscar T. Tamm and Henry Upmeyer, of Tamms, and Joseph Mayr, Jr., of Jonesboro, who will be manager. The capital stock is $50,000. The plans contemplate the erection of a flour mill with a daily capacity of 400 barrels.

Edwin R. Kent & Co., tool and other steel, etc., 10 South Canal street, Chicago, have taken over the business of Edgar Allen, 51 John street, New York city, and will, April 1, open up a branch store there under the name of Edwin R. Kent & Co., with Thos. E. Whiteside as Eastern manager.

The Cascade Electric Company, of Grand Rapids, Mich., has been formed to erect a power-house and dam on the Thornapple River at Cascade, which will give 1,000 horse-power. The president is E. C. Follmer; vice-president, Charles E. Mercer, and secretary-treasurer, E. A. Stowe.

The Chamber of Commerce, Sandusky, O., has received a proposition from the Milholland Sand-Lime Company, incorporated with an authorized capital of $100,000, which proposes to erect a brick plant there and also plants at Marion and Dayton. Horace Whayman, of Dayton, is president.

It is reported that Mr. Taylor, of Dallas, Tex., has made a prospectus for the establishment of a 100-ton cotton oil mill at Beaumont, to be known as the Beaumont Cotton Oil & Export Company, with a capitalization of $200,000. The proposition is being considered by the local board of trade.

The Hampton Roads Boat Building Company has been incorporated and will erect at once a plant at Newport News, Va., for building sailboats, power launches and rowboats. A marine railway will be built. Frank L. Small is president; A. W. Drew, vice-president and general manager, and Godfrey L. Smith, secretary.

The Home Brewing Company, of Grafton, W. Va., with $200,000 capital, has been formed. H. P. Ecker, of Pittsburg, is president; William Jennings, of Grafton, business manager. The contract for the erection of the plant has been let to John V. Knoth, of Pittsburg, at $158,000. The plant is to be ready for operation by November 15.

At Williamsport, Ind., it is stated that the Fowler & Stufflebeam Manufacturing Company will build a plant at "Judyville" to manufacture corn shredders, the Home Safety Shredder Feeder and several farm implements, and will have an equipment for engine and machine repairing. The Judyville Promoting & Investment Company can probably give information.

The Tilghman-Brooksbank Sand Blast Company has been appointed by B. C. & R. A. Tilghman sole agents for the sale of all sand blast machinery and supplies manufactured by them under the Tilghman and Matthewson patents. The company's address is 409 Commerce street, Philadelphia, Pa. F. C. Brooksbank, formerly with E. T. Ward & Sons, Boston, is general manager.

The American Radiator Company, of Chicago, has secured a tract of ground at Litchfield, Ill., for a big manufacturing plant. The buildings will include two foundries, 90x425 feet each; corercom and ovens, 90x125 feet; machine shop, 90x160 feet; storage and warehouse, 120x320 feet; offices, 30x80 feet, and a power plant, 40x120 feet. The cost of construction, without equipment, will be about $200,000.

The Pope Clay Product Company, of Aiken, S. C., has been incorporated; capital stock, $700,000. The incorporators include Messrs. Mosser and Murphy, of Harrisburg, Pa. This concern is backed by Andrew Carnegie, and will manufacture aluminum from the kaolin with which Aiken abounds. The manufacture of pottery, glass and fire-brick is also proposed. We published information about this enterprise a few weeks ago.

The Semet-Solvay Company interests, of Syracuse, New York and elsewhere, are planning large improvements at their plants in Milwaukee, Wis., and Chester, Pa. The principal business done at these plants is the manufacture of coke. Trolley systems will be installed at the works and electric power will be used for moving freight. Wiring contracts in connection with some of the improvements have already been awarded.

George H. Nissen, of Douglas, Lacey & Co., who are said to be of Prescott, Ariz., and New York city, promoters of the Nissen circular independent stamp motor, has been at San Diego, Cal., and conferred with C. W. French and his associates in reference to the proposed steel plant. Mr. Nissen says that it is the intention of his people to establish a plant for the manufacture of their article at San Diego, provided the steel plant proposition goes through.

Toledo, O., and Detroit, Mich., capitalists are interested in a large plant which will manufacture heating apparatus and machine tools. It has been incorporated in Ohio for $200,000. It is known as the C. E. Sutton Company. The incorporators are Chas. E. Sutton, Curtis T. Johnson, Ralph A. Holbrook, S. D. Carr, E. T. Rowley. The plant will be located in Toledo. It is a consolidation of three concerns, the Caldwell Furnace & Foundry Company, of Toledo; the Burnham Tool Works, of Jackson, Mich., and another Michigan company. The Michigan plants will be brought to Toledo and additional machinery and men placed in the Caldwell plant.

New Catalogs.

The Carlyle Johnson Machine Company, Hartford, Conn. Booklet describing the Johnson frictionless clutches. Illustrated.

The "O. K." Tool Holder Company, Shelton, Conn. Patent tool holders, with tools and fixtures for lathes, shapers and planers. Illustrated. 3½x6.

We have received from the United States Graphite Company, Saginaw, Mich., an attractive little booklet on graphite lubrication. Illustrated in colors.

Charter Gas Engine Company, Sterling, Ill. Charter gas and gasoline engines and Sterling portable gasoline engines. Illustrated by photographs and sectional drawings. 6x9, pp. 47, paper.

Newton Machine Tool Works, Philadelphia. Rotary planers, stationary, portable, mounted on round base, duplex, vertical, etc. Illustrated by photographs. Catalog No. 37. 6x9, pp. 15, paper.

J. M. Westmacott Company, Providence, R. I. Gas blast furnaces for annealing, hardening, tempering, etc.; smelting furnaces and drying and baking ovens. Illustrated. 5½x7½, pp. 28, paper.

The Crocker-Wheeler Company, Ampere, N. J. We have received from this company a handsome special bulletin descriptive of Crocker-Wheeler generators for railway service. Illustrated by photographs.

Willamette Iron & Steel Works, Portland, Ore. We have received from this company a catalog describing and illustrating in detail the design and construction of "Willamette" logging engines. 7½x9½, pp. 47, paper.

The Cincinnati (Ohio) Shaper Company. Traverse shapers, including 16-inch, single head, and 18-inch, 24-inch and 36-inch with one or two heads. Each size illustrated by photograph and amply described. 6x9, pp. 11, paper.

Combined Punching Machine and Slitting Rolls.

BY W. H. EISENBEIS.

In the large workshops of the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., is a very interesting combination of slitting rolls with an ordinary punching machine for the production of sheet-iron stampings for transformers. This company has always advocated the use of shell type transformers, the windings of which consist of a number of thin coils placed side by side, enclosed in and protected by the core. In order that the magnetic flux produced by the primary coils may thoroughly envelop the secondary coils, an iron path is provided about each leg of this group of coils, as may be seen in Figs. 1 and 2. The iron must be laminated to prevent the generation of wasteful eddy currents in the core, and the laminæ must lie in planes parallel to the direction of the magnetic flux. The laminations consist of sheet-iron stampings, which are assembled, as shown in Figs. 1, 2 and 3, in horizontal planes about the vertical legs of the coils.

In the smaller sizes of transformers, each lamination may consist of a single stamping, cut through on one or more sides to permit of its being placed about the coils. In large transformers, however, it becomes necessary to divide each layer into several parts, in order to facilitate the work of building up the core and to economize in sheet iron. This company has adopted a standard shape, shown in Fig. 4, for these divisions. Each piece, as may be seen in Fig. 3, forms one side of the lamination. The same die and punch may be used to cut the parts for the four sides—provision being made to cut two of the four parts longer than the others. These parts were formerly cut singly from the sheet iron, with dies and punches the shape and size of each entire piece. Recently, however, a set of slitting rolls has been added to the punching machine which enables an operator to cut from six to eight stampings in one operation. One set of dies makes both sizes of plates where formerly it was necessary to cut each singly and with separate dies.

The apparatus consists essentially of the punch and die and the slitting rolls, as sketched in Fig. 6. The sheet iron *a* is fed from the table *b* of the machine in single sheets into the rolls. These rolls feed the sheet iron into the machine and guide it to a proper position to be punched, while at the same time they shear the iron into strips of the exact width desired. To finish the strips it is therefore only necessary for the punch to make the end cuts, as may be seen in the sketch. The die is made in two parts *c d*, one for each end cut, which may be set to cut long or short strips.

The rolls consist of a mandrel, on which are mounted the individual rolls, separated from one another by the iron washers *e*. The individual rolls are each made up of three separate parts to facilitate grinding. Of these, the central part *f* carries the cutting edges, while the outer parts *g* serve as rolls in the true sense of the word, and roll the edges of the strips perfectly smooth as they pass through. The rolls being set to the thickness of the sheet iron prevent the formation of troublesome burrs which were formed in the older method of stamping, and frequently required an extra rolling process to make them smooth.

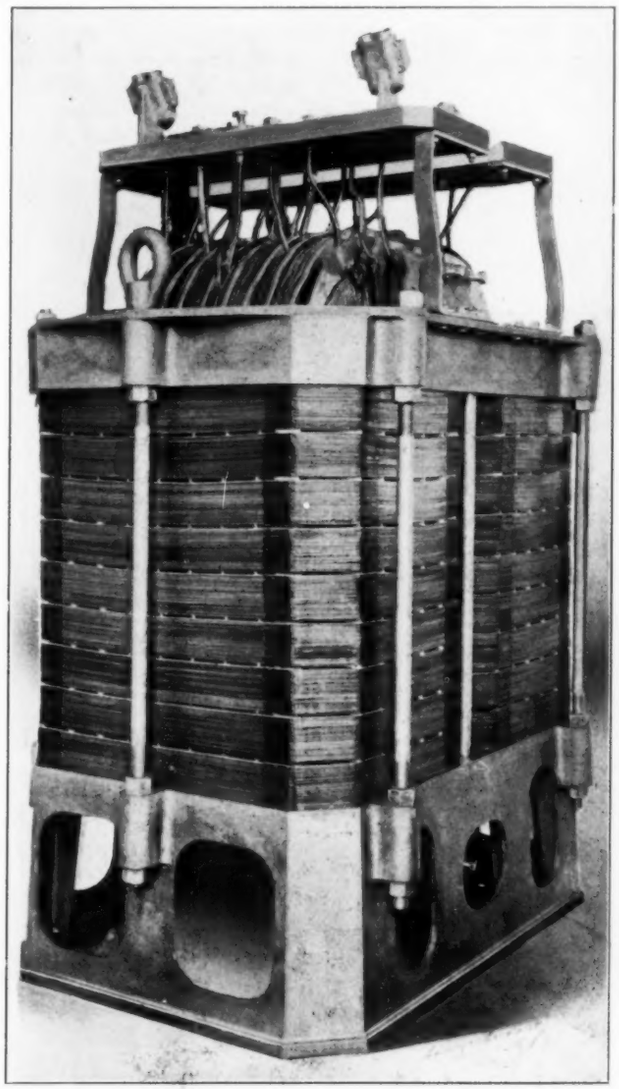


FIG. 1. COMPLETELY ASSEMBLED TRANSFORMER.

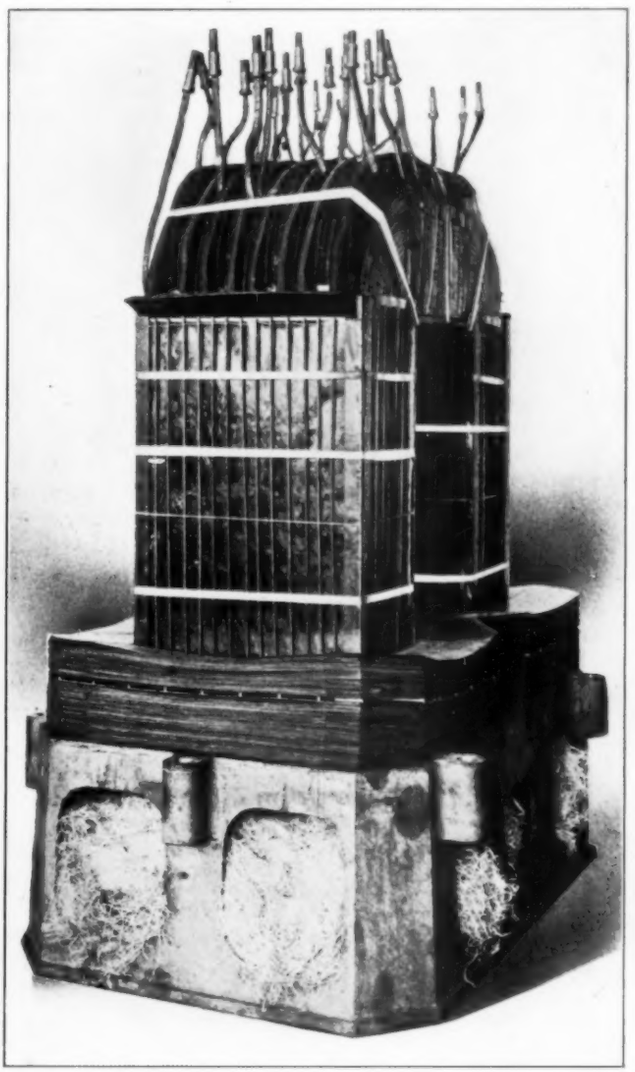


FIG. 2. PARTLY ASSEMBLED TRANSFORMER.

The rolls are driven by a train of gears operated by a crank and lever attachment to the main shaft of the punching machine. The entire arrangement is attached to one side of the machine, as shown in Fig. 5. A small gear (not shown in the illustration) operates the rolls and engages with a large intermediate gear mounted on one side of the machine and partly shown under the casing. This intermediate gear is prevented from moving too freely by the pressure of two set-screws, one on each side. On the same shaft with this intermediate gear there is hung a lever arm to which is connected a crank operated by, and set eccentric with, the main shaft of the punching machine. The lever arm has attached to it a ratchet and pawl, and to the former is attached a small gear wheel (not shown in the illustration) also engaging with the intermediate gear. The operation is as follows: On the downward stroke of the punch the eccentric on the end of the main shaft drives the connecting rod down, forcing the lever arm to rotate, carrying with it the small gear and ratchet wheel. This small gear does not affect the intermediate gear on the downward stroke since the latter is held from freely turning by the set-screws and the pawl snaps over the teeth of the ratchet. On the return stroke, when the punch has completed its cut, the eccentric carries the connecting rod and lever arm upward. The pawl engages the ratchet wheel, preventing the small gear attached to the latter from revolving around the intermediate gear with the result that the friction of the set-screws is overcome and the intermediate gear rotates, causing in turn the small gear attached to the rolls to rotate a predetermined amount, dependent on the length of the lever arm. The position of the attachment of the connecting rod to the lever is of course variable.

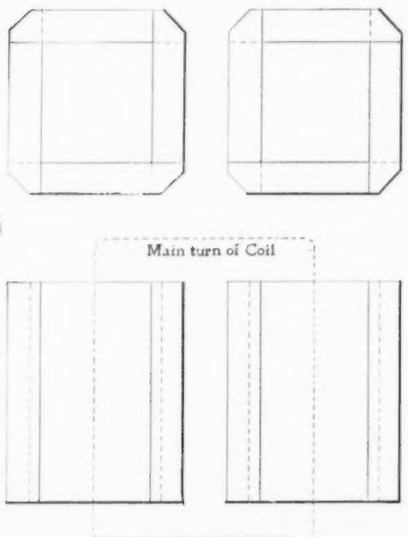


FIG. 3. ASSEMBLY OF SHEET IRON CORE.

FIG. 4. PUNCHING FOR TRANSFORMER CORE.

The machine then, with this attachment, accomplishes several operations in one cycle. It feeds the material automatically to the punch, at the same time slitting it as described and finally punches it to the desired shape, and does this all with a very decided saving of material. There is also a large gain in the rate of production, the rolls give better workmanship, more rapid production, and a lower factory cost for the product.

Laboratory vs. Shop.

BY W. S. LEONARD.

I had been waiting for someone to reply to the article "Laboratory vs. Shop," published in the AMERICAN MACHINIST at page 74, when my attention was called to the answer at page 219. Mr. Smith has made a strong presentation of his side of this question, and the reply of Mr. Magruder, though valuable as indicating what may be done under favorable conditions, is not altogether satisfactory as applied to engineering colleges. I quote Mr. Smith as follows: "A system of progressive and rapid instruction . . . cannot be realized by any workshop method, or even by a mixed method combining teaching and manufacturing." Mr. Magruder says: "For technical students who have but a limited time to devote to the study of machine-shop operations, the rapid, systematic and progressive method pursued at the institutes of technology is perhaps the best." Thus he virtually concedes all that Mr. Smith contends for.

In answering both Mr. Smith and Mr. Magruder, it may be admitted that the laboratory method has some important advantages as compared with the workshop method. By the laboratory method we may select the best exercises and the tools best adapted to the work, and, by continual repetition, discover the best way of imparting the instruction, and, because the same exercises are executed over and over again, the work of the instructor is much easier. This circumstance makes it practicable to employ cheaper talent for the

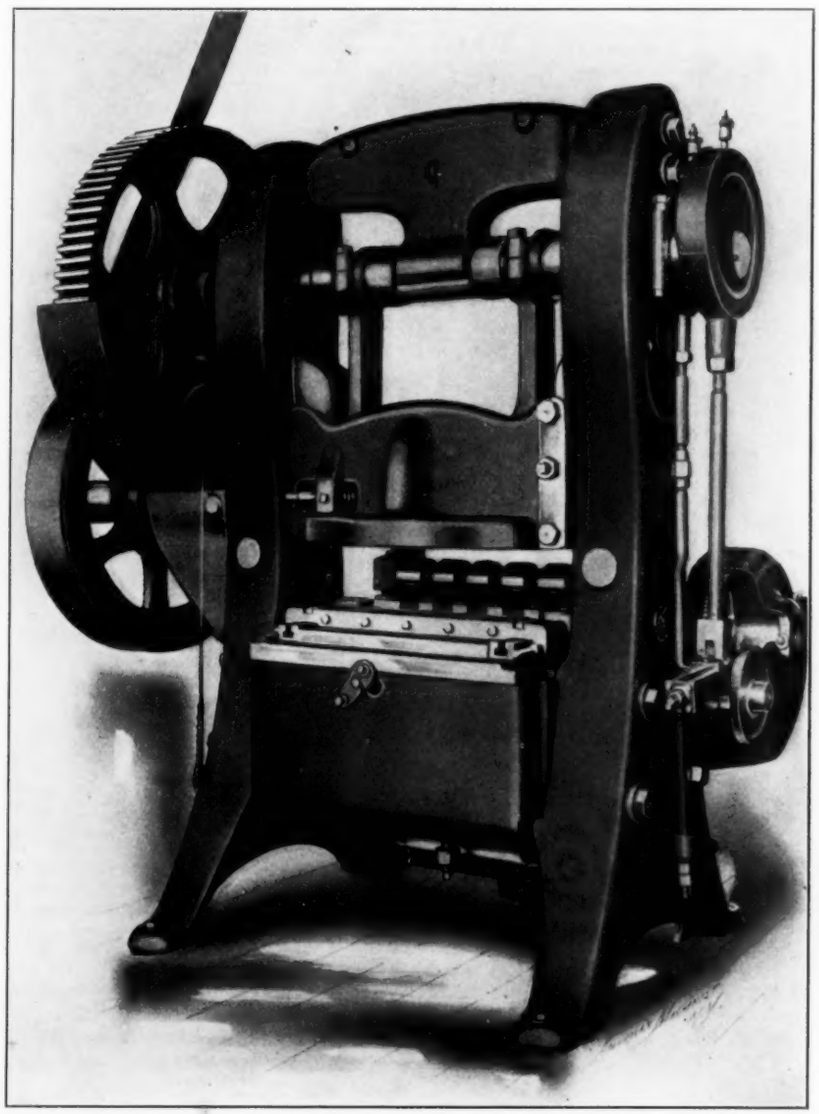


FIG. 5. PUNCH PRESS WITH SLITTING ROLL ATTACHMENT.

instructing. We may go a step further and admit that if we have in view the narrow purpose of teaching the student how to chip and file, to do lathe work, planer work, milling, etc.; in short, if we wish to teach mere tool manipulation, the laboratory method cannot be surpassed, but such a plan is more in accord with the object of the manual training schools. The engineering school should have a different object, or at least a wider scope to its shop work. It is true that so long as most engineering students come from schools which have no manual training work, the shop training which can be given in the colleges must, for want of time, be deficient; but, nevertheless, we can do better for them than give them disconnected or unrelated exercises which have no other value than that of conveying instruction.

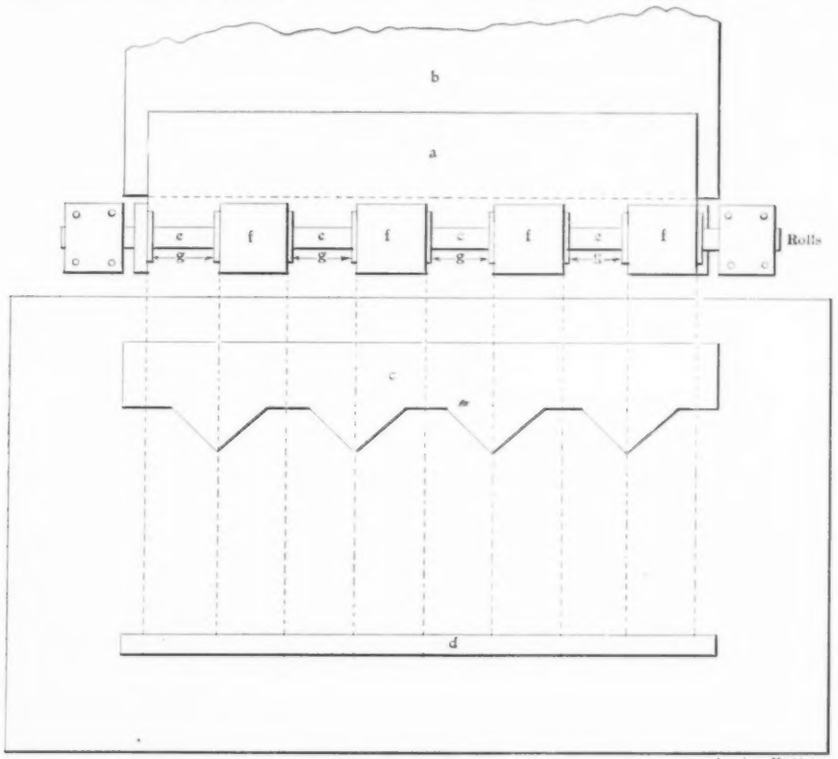


FIG. 6. PLAN SKETCH OF DIE AND SLITTING ROLL.

I have spent a large portion of my life as a machinist and draftsman in manufacturing establishments, and have observed that most practical men expect too much of young technical graduates—especially in the machine shop. In this connection it may be well to remind these critics that shop work is a very small part of an engineering course. The student cannot reasonably be expected to accomplish as much as the machinist who has worked a score of years at one specialty.

Mr. Smith speaks strongly of the enthusiasm manifested by his pupils in connection with the laboratory method. It is true that a great deal of ground may be covered in this way, but my experience is that the pupil shows more enthusiasm in making some part of a machine. Most students are disappointed when they find that the details which they have shaped with so much care are finally to be remelted or thrown into the scrap heap. The moral effect is somewhat akin to that of kindergarten work. The student feels that he is being treated as a child and not as a man. It may be urged that the same objection will apply to all the theoretical studies, but I do not think so. An abstract science like mathematics, for instance, is regarded differently. If it were possible to turn all the work of a college to practical account, the effect upon the student would be beneficial. Such a system would show the utility and application of the various studies, and give to the student a sense of responsibility which is noticeably lacking in the average college graduate.

Is it possible to combine most of the good features of the laboratory method with the shop method? Mr. Smith says no. In taking issue with him on this question I shall outline the plan we have endeavored to follow at the Michigan Agricultural College, including a brief reference to one of the classes in machine design. I have charge of the machine shop and also teach during the winter and spring terms a class in practical machine design. In this class we take up shop machinery chiefly, including lathes, planers, milling machines, etc., and endeavor to conduct the work much as in a regular drafting office, making only such modifications as educational requirements necessitate. By lectures and typewritten matter the attention of the student is directed to those methods and regulations which have been found to give the best results in practice. He is also referred to discussions in technical journals relative to the machines being designed, and to articles on drawing-office systems. Sometimes the instructor reads to the class criticisms of technical graduates published in mechanical papers. The student thus learns what will be expected of him when thrown upon his own resources, and discovers the weak places in his armor which need to be strengthened.

It is the intention that each machine designed shall compare favorably with those built by manufacturers. Complete assembly and detail drawings are made and the students are given to understand that the machines are likely to be built in the shops. Generally some of the patterns are started within a few weeks (of ten class hours per week) after the designing is be-

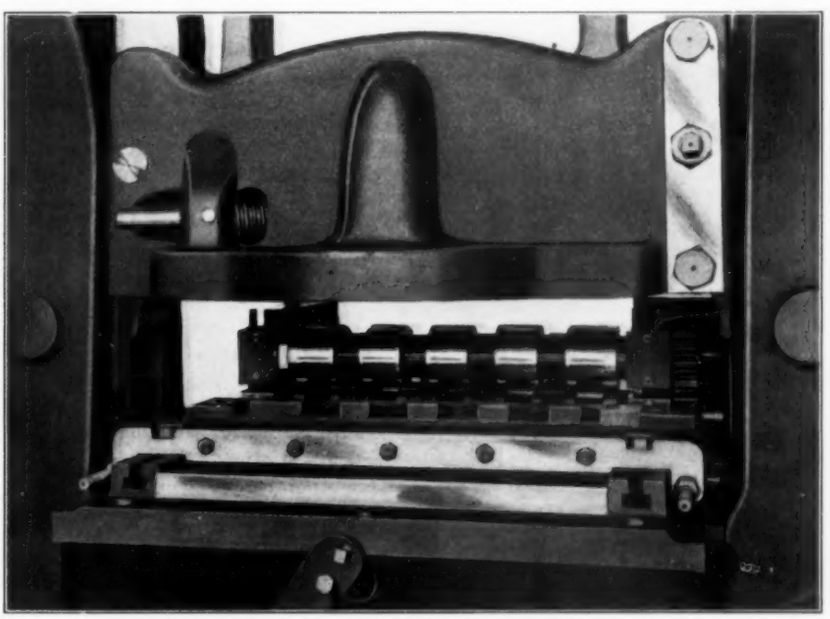


FIG. 7. ENLARGED VIEW OF DIES AND SLITTING ROLLS.

gun. If the patternmaker calls attention to any errors which have been overlooked in the designing room, the student responsible for such errors is sent to the pattern shop to investigate and make the necessary corrections. The methods of molding and machining difficult parts are considered and discussed, and the effort is made to design the whole machine with reference to the most economical construction. Under such conditions the work of both instructor and student is more thorough and exacting than it would be if there was no intention to build the machine. A feeling of interest and responsibility is also developed which would otherwise be impossible. As illustrating the difference between designing machinery merely as exercise work and designing it to stand the test of actual construction and operation, I recall a very fine drawing of a steam engine governor made under the supervision of a professor in an Eastern college. This governor made a very pretty picture to hang up in the classroom, but it would never have governed the speed of an engine. There were errors in the work which were never discovered by the professor, and when the student found them he would not tell.

Is it not reasonable to suppose that a similar indifference is experienced in connection with exercise work in the machine shop to that felt by the student who made the governor drawing? The knowledge that the pieces to be made have no commercial value, and are never to be subjected to the test of being assembled into an operative machine, must tend toward this indifference; and such lack of responsibility is not conducive to the highest educational advancement of the student. A mock battle can never furnish that high order of training and military spirit that is developed in actual warfare.

It has been our policy to employ the laboratory method in combination with the workshop method. As indicated above, we aim to build most of the machines designed by the class. As fast as the castings are made in the foundry they are given to the students to machine. We observe this precaution, however, that when a machine casting does not furnish the proper instruction, an exercise from the regular list is used instead. We have a carefully graded list of exercises on the laboratory plan; but whenever a machine detail furnishing approximately the same instruction is to be had, we give it to the student instead of the exercise. If a student is ready to make a square-thread screw and a similar screw is needed for a machine, the screw for the machine is made. If he is ready to make a spur gear and the machine drawings show such a gear, he works by the machine drawings instead of the exercise drawing, and so on. If, in addition to this work, the students are required to do the fitting, squaring and alining necessary in assembling the machines, they receive an important class of instruction for which, if I mistake not, Mr. Smith's laboratory method makes no provision.

The question arises: Is it practicable to design such articles and machines as shall furnish the full variety of elements required in a college machine-shop course, and thus eliminate all, or nearly all, the purely exercise work? Such a scheme would not appear to be impossible, and some advance steps in this direction have been recently taken in our mechanical department. This is a different proposition from that referred to in Mr. Smith's article. In trying to prove that the workshop method would work injury to the interests of the students, he cited the example of certain colleges which give a class of students one machine, a steam engine, for instance, to build. Each student makes a few pieces and none of them gets anything like a suitable range of work. But if machines and devices be designed so as to cover the required range of work instead of the range of work being dependent upon unsuitable machines, the difficulty to which Mr. Smith refers will be obviated. Another important condition is, of course, that the machines built shall meet a commercial demand.

In operating college shops on a commercial basis it is advantageous to employ, in addition to the instructing force, one or more skilled mechanics. These mechanics may do any of the work which, for various reasons, it is not desirable to give to the students. In order that the students may become familiar with the best modern practice, it is necessary that jigs, special fixtures, etc., be used to a considerable extent. A good shop order and cost system should also be employed.

Let us sum up the advantages of the machine-shop course here advocated as compared with the laboratory method:

First—The machines to be manufactured, being designed and built in the college shop, the student comes in contact with the work in all its stages. Under such conditions he will get the training due to making the details the same as by the laboratory method, and, in addition thereto, that other training which is, perhaps, more valuable, viz.: a knowledge of the function these details perform as parts of a complete machine.

Second—Knowing the functions of the various parts, the student will understand what parts of the work require special accuracy and what parts may be made with a less expenditure of time. Every mechanic understands the advantage of such knowledge.

Third—The fact that the work has a commercial value enlists the student's interest and causes him to attach to it a degree of importance which, of itself, must increase the educational value of the work.

Fourth—If the shop order and cost-keeping systems are used, the student gets another kind of training which is of value to the engineer.

To carry out the plan here outlined involves hard work on the part of those in immediate charge of the shop, and to make it successful necessitates a liberal expenditure of money for proper equipment. But the writer believes that such a system, or a near approach to it, is expected of universities, and that such work would be appreciated by the "captains of industry" to whom the technical graduate applies for employment.

The Anti-Tuberculosis Crusade.

The support of organized labor, pledged in meetings of the United Garment Workers of America, of Typographical Union No. 6 and of the Central Federated Union, has marked the past months in New York as a starting point in a movement full of promise in the campaign for the prevention of tuberculosis. The Committee on the Prevention of Tuberculosis of the New York Charity Organization Society has endeavored to show to the trades union leaders that this reform is one that will benefit the rank and file of trades union members, not indirectly but through the ultimate savings in sick benefits, if in no other way, on the financial prosperity of the unions.

Thus there is now good promise of getting into the hands of every trades union man in New York city, and posted on the walls of every union shop, the few simple health rules which the anti-tuberculosis committee of the trades is now drawing up, of getting this mass of wage-earners to co-operate with their committees in the enforcement of these rules in shops and homes, and in bringing to the attention of the readers of the many union papers more extended explanation of the means of prevention and methods of cure.

Meetings will be arranged with the different unions, and then, when the movement has gained sufficient momentum, it may not seem impracticable even to attempt to set in motion a crusade which will have for its object the prevention of expectoration on the highly disgusting sidewalks in highly respectable portions of New York.—*Charities.*

The 5,000 horse-power steam engine built by the Allis-Chalmers Company for the St. Louis Exposition required twenty-one cars for its transportation, the total weight being 720 tons in 202 packages. The heaviest single piece, which weighed 73 tons, was the main shaft with the hub of the flywheel.

To empty a tank with a waste pipe standing up 4 inches from the bottom a man took a glass jar, filled it while the tub was emptying and inverted it over the pipe, thus forming a siphon which drew off all but a very small portion of the water.

Milling Machine Feeds and Speeds.

The determining of the proper feeds of milling cutters in the past was usually a matter of guesswork, or experience, as a good many would term it, no absolute rule of any kind having ever been established.

On the other hand, the speeds of milling cutters have been fairly well established. A good average for the surface speed of an ordinary tool-steel cutter, when used in a milling machine, is 20, 40, 60 feet respectively for steel, cast iron and brass. For the air-hardening tool steel cutter, the surface speed may be increased from 50 to 75 per cent. The surface speed of an ordinary tool-steel cutter, when used in a standard gear cutting machine, is generally 40, 60 and 80 feet respectively for steel, cast iron and brass. This increase in surface speed over the regular tool-steel milling cutter is due to the fact that the conditions of the standard gear cutting machine have been so provided to adapt it for just one kind of work where the overhang of parts is reduced to a minimum.

The object of this article is to demonstrate that a guide for determining the proper feed of milling cutters is found in ascertaining the thickness of the chip per tooth of the cutter.

Let us take, for example, an average size milling cutter working in cast iron, say, 2½ inches diameter, 3 inches long, with eighteen teeth, which is quite universally used, and we will find that the thickness of the chip per tooth is quite small, resulting in .0018 inch, with a table feed of 2 inches per minute. This is entirely too slow. Now, comparing this cut of .0018 inch with a lathe tool cut, with which all of us are familiar, we readily see that such a chip in a milling cutter is much smaller and is far more injurious to the cutter than a heavier feed, since the cutting edge of a tool will hold up longer in cutting into the metal instead of scraping it. A standard 6-pitch gear cutter cutting cast iron at the rate of 5½ inches per minute, which is considered fairly rapid, averages a chip per tooth of only .0067 inch. The gear cutter is here mentioned only to demonstrate the possibilities of other classes of milling cutters.

A cutter is very seldom ruined by the feed, but is generally ruined by overspeeding it. If we take for instance a cutter of thirty teeth with a table feed of .300 inch per revolution, which is one of the heaviest feeds as furnished by milling machine builders of to-day, the chip per tooth will then only be $\frac{.300}{30\ T} = .010$ inch thick—still quite a light cut when comparing it with a lathe tool chip. Hence in many cases of milling, if we guide our feeds by the thickness of chip per tooth, a much faster feed would be used more generally, since it is evident that the heaviest feeds, comparatively, give only a thin chip per tooth.

The question of power in milling is today quite an important subject, and a great deal depends on the form and shape of cutter used. Roughing cutters should invariably be coarse-toothed, and, if possible, never have more than two or three teeth in contact with the metal.

Below is tabulated the results of a test of power consumed by two identical roughing cutters, Figs. 1 and 2, with the exception that one contained thirty teeth and the other fifteen teeth:

	Fig. 1. Cutter.	Fig. 2. Cutter.
Diameter of cutter.	4″	4″
No. of teeth in cutter. . . .	30	15
Width of cutter	9/16″	9/16″
Depth of cut	⅞″	⅞″
No. of teeth in contact with metal.	5	3
Volts	110	110
Amperes	13.5	10.5
Feed of table.	.134″	.134″
Rev. of cutter p. m.	40	40
Thickness of chip per tooth.	.0044	.0088

TEST IN CAST IRON.

The machine on which this test was made was a No. 3 Cincinnati motor-driven, positive-feed miller connected with a Weston volt ammeter, so that very accurate readings of the power required for the two cutters could be taken. You will observe that the thirty-tooth cutter required 13.5 amperes, while the fifteen-tooth cutter required only 10.5 amperes on the same cut, a saving of about 22 per cent. This is plainly obvious, since the thirty-tooth cutter had constantly five teeth in contact with the iron, while the fifteen-tooth cutter had only three teeth in contact, proving that the more bites a cutter must take, the more power is required, irrespective of the fact that the fifteen-tooth cutter took a larger chip per tooth than did the thirty-tooth cutter.

This clearly demonstrates the advantage of a coarse tooth cutter for heavy milling, not only through its economic use of power, but also because of its greater durability. A cutter of this kind will also permit of a heavier feed, especially on deep cuts, since ample space exists between the teeth for the escape of the chips, which would be impossible with a fine tooth cutter.

For finishing cuts a finer tooth cutter should be used, which will greatly lessen the feed marks for a smooth milled surface. This is quite readily permissible, since these cutters have no great amount of metal to remove, and the space between the teeth is ample for the escape of the chips.

The points enumerated above need not be absolutely adhered to for ordinary milling, but if the very best results are aimed at with a view of increased production, it would be well to bear them in mind, especially when constructing roughing and finishing gangs.

Great care should be exercised when sharpening cutters to give them the proper angle for clearances, the life of the cutter being thereby materially lengthened. A 5-degree clearance for finishing and 7-degree clearance for roughing produces very very good results. A table showing how these different angles for different diameters of cutters can be obtained is published in the "Grinder Treatise" of the Cincinnati Milling Machine Company.

Whenever feasible, as small a cutter as possible should be used. They are not only less costly, but require less power for driving when milling.

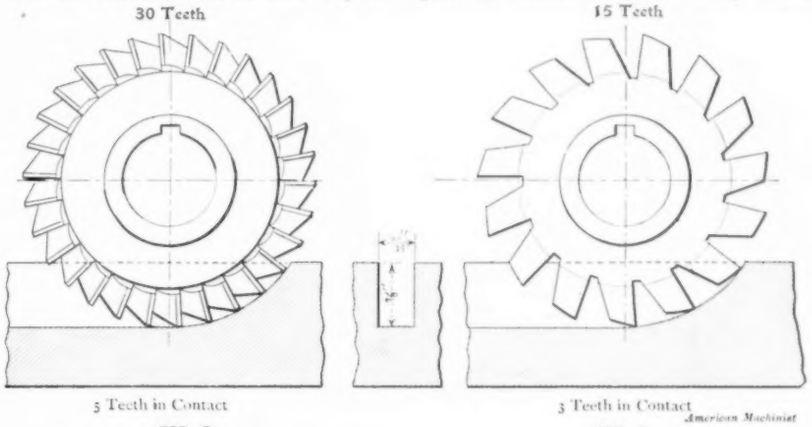


FIG. 1. FIG. 2.

COMPARISON OF FINE PITCH AND COARSE PITCH CUTTERS.

When milling steel, a heavy flow of oil on a milling cutter, forced by means of an oil pump, is just as essential as the great volume of oil which is used on automatic screw machine tools, which would not hold up one-half hour if not so flushed. The life of a milling cutter amply lubricated will be materially prolonged and it will be capable of standing a much heavier feed.

The foregoing remarks apply to practice in general, but on jobs where conditions are favorable still better results can be obtained. For example, we have milled with an end mill 3 inches diameter, twenty teeth, 2½-inch face, at a table feed of 15 inches per minute. This mill was mounted on the nose of a horizontal spindle miller where there is no overhang, and ran at a surface speed of 40 feet per minute.

The milling machine table in this case advanced .300 inch per turn of the cutter, which gave a chip per tooth of .015 inch. This same piece was then finished with a table feed of 25 inches per minute, with the cutter rotating at a surface speed of 65 feet per minute, producing a surface so smooth that the cutter marks could be easily polished off by means of emery cloth. After milling thirty pieces, 2½ inches wide, 12 inches long, the cutter was still in good condition.

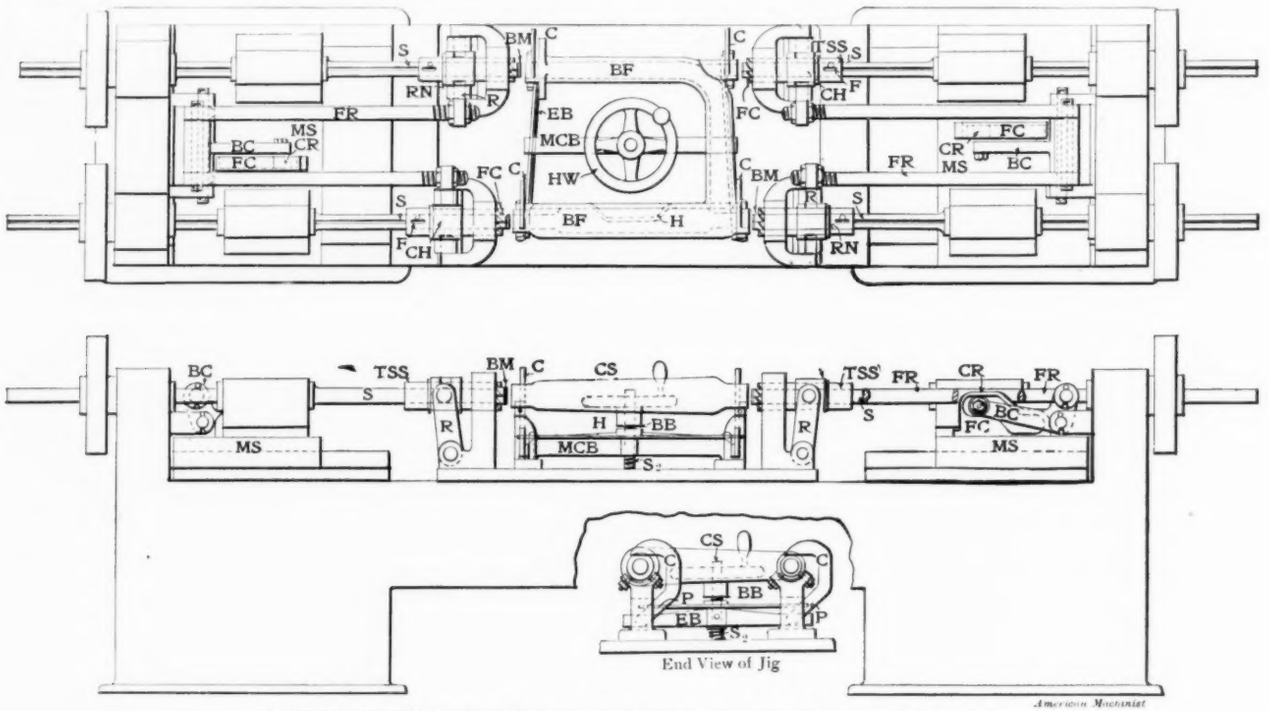
Boring and Facing Binder Frames.

BY S. A. WORCESTER.

The binder frame casting *B F*, which is shown in place in the jig ready for boring and facing in the Beaman & Smith horizontal boring machine, had formerly been finished one pair of holes at a time, and two machines were used for the work. The frame was taken to the first machine and clamped in the jig with four separate hand screws; two of the holes were bored and the two hubs were faced after the boring by feeding the bar onward until the facing cutter which was held on the bar by a set-screw, completed its work. The frame was then taken to the other machine, clamped in another jig and the other two holes were bored and the hubs faced as before.

When the new machine with its four spindles arrived, I was instructed to design a jig and cutters and all necessary apparatus for boring the four holes and facing the four hubs at one setting. On looking over the work I concluded that two important time savings could be included in the design. The first and most important saving is in doing the facing during the boring operation, and the second is in clamping and unclamping the casting at a single operation. The new machine is arranged to bore four holes at once and to face four hubs during the boring operation, so that the facing requires no additional time. The four clamps are all swung over the work by pulling one handle, and all are tightened or released by turning one hand-wheel in the center of the jig. The four splined tool-steel spindles *S S S S* of the machine, which is partially outlined here, are driven by powerful gearing and are fed by the two main saddles *M S* which are fed by a heavy gear train and worm feed, the usual feed for this type of Beaman & Smith machine, with an adjustable trip for disengaging the worm. The butt mills *B M*, about 1¼ inches diameter and 7 inches long, are screwed into the ends of *S S S S*. The hollow facing mills *F C*, about 2½ inches long, are screwed into the ends of the tool-steel sleeves *T S S*, which are driven each by two feathers *F*. These sleeves are necked or grooved, and have hardened rings in halves which are a running fit in the grooves in the sleeve and are held stationary in the crossheads *C H* by the ring nuts *R N*. These sleeves with their facing cutters receive their feeding and withdrawing motion through the crossheads *C H*, rockers *R*, rods *F R*, bell cranks *B C*, rollers *C R* and cams *F C* which are fastened to the main saddles *M S* and travel with them. It will be seen that the cam feed is such that the facing is done after the boring has progressed a short distance.

The four clamps *C* are raised or lowered by the main cross-bar *M C B* through the two equalizing bars *E B* to which they are connected by pins. This cross-bar *M C B* is drawn down by the hand-wheel *H W*, which has a ball bearing at *B B* and a threaded hub which screws on the center stud *C S*. The bars *M C B* and *E B* are raised by the spring *S Z* when the hand-wheel is run up. This allows the four clamps *C* to fall backward by their own weight until the pins *P* stop against *E B*. When the binder frame is placed in the jig the four clamps *C* are swung up over the work by pulling the handle *H* with the left hand, while the hand-wheel is screwed down two or three turns with the right, tightening all four clamps equally, and the frame is now ready for boring. After the work is finished and the spindles are run back, releasing the work is a still easier operation, because the four clamps drop out of the way by their own weight as soon as the hand-wheel is unscrewed two or three turns.



BORING FOUR HOLES IN BINDER FRAMES AND FACING HUBS AT THE SAME TIME.

All sorts of dire predictions were made for this machine, but it gave practically no trouble from the start. Another department which had a Beaman & Smith four-spindle machine on much larger work installed about a year earlier and had been doing its facing after the boring, facing with two spindles at a time, after seeing this binder frame machine run a few weeks decided to equip its machine similarly, although I had tried in vain to persuade the foreman to use this arrangement when the machine was first installed.

The General Electric Company has established at the Schenectady works a drafting room apprenticeship course, to which young men who are able to pass a satisfactory examination in arithmetic are eligible. The course is intended to fit applicants for drafting-room positions.

Profit Sharing in Germany.

BY HENRY HESS.

In many German establishments it is quite customary to make Christmas presents in cash to various officials of a firm. In 1888 Mr. Freese, of Berlin, decided to drop this "gratification" and in its place to give an interest in the success of the concern to the extent of 2 per cent. of the net profits, each individual to share in proportion to his salary. Two years later the plan of profit sharing to the extent of a further 2 per cent. of the total profits was extended to the shop force. Since then the shares have been raised to 5 per cent. for the office and 7.5 per cent. for the shop force, a total of 12.5 per cent. of the gross profits. Considered with relation to the salary or wage earnings these profit shares varied between 4.4 and 24 per cent. of the office salaries and 0.5 and 7 per cent. of the shop wages; in the eleven years reported the office participated to the extent of an average of 10.5 per cent. of its salaries, while the workmen in nine years netted an average increase of pay amounting to 2.43 per cent. The figures in detail are:

	Shop force.	Office force.
1888.....	0.00 p. c.	4.40 p. c.
1889.....	0.00 "	9.50 "
1890.....	0.63 "	9.97 "
1891.....	1.00 "	9.00 "
1892.....	1.20 "	6.71 "
1893.....	0.43 "	3.00 "
1894.....	1.91 "	9.63 "
1895.....	2.60 "	12.14 "
1896.....	3.55 "	17.20 "
1897.....	3.18 "	1.16 "
1898.....	7.33 "	24.64 "

Of their share the workmen receive two-thirds in cash; the remaining third is devoted to a benefit fund that is under their management. Mr. Freese first distributed the profit shares to his men in the usual way in pay envelopes, but later on adopted the plan of a public meeting opened by a short report on the past year's business, and found that method the more effective as a spur to increased efforts.

Workmen that have quit during the year are called on to receive their shares by public advertisement. Such shares are held at their disposition for three months; those not called for at the end of that time are equally divided among the workmen's benefit and amusement funds.

Mr. Freese does not grant the right to an inspection of the books. He advocates making the percentage of the profit to be shared as large as is possible, since small sums have no effect in spurring the workmen to increased efforts, but is cautious against too great initial liberality as carrying with it the possibility of an enforced reduction next time with its attendant bad effects; a gradual increase is every way to be preferred.

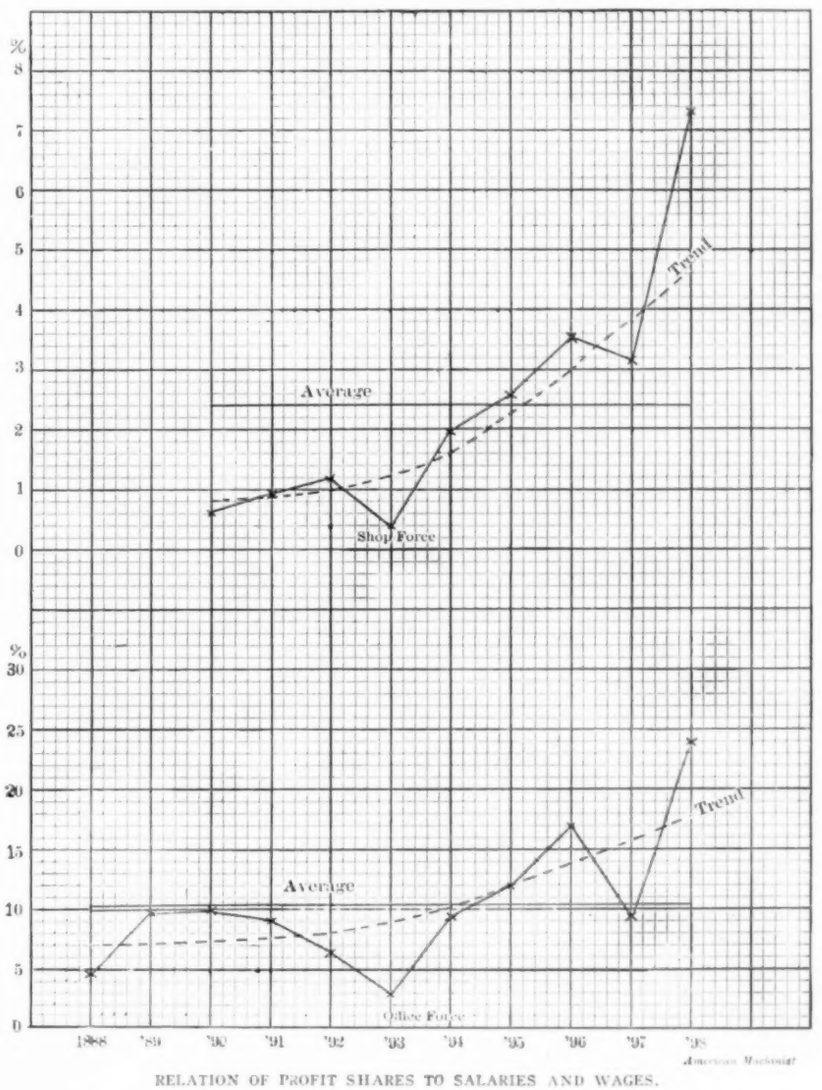
An attempt to tie the men to the concern by accumulating a portion of the profit shares for some ultimate and remote benefit that in any way involves a loss on leaving the firm's employ is deprecated as unjust. The point is made that the profit share is given in return for services already rendered and not for future ones. Neither does Mr. Freese accord an advantage to workmen of long service, considering the continuity of work in itself sufficient.

The greater influence that the office force has in the welfare of the business (according to Mr. Freese) is recognized by setting aside a separate portion of the profit as its share. With the relatively small number of men in the office force that gave sums to the younger men that were rather disproportionately high when compared with the value of the services rendered by the shop officers. For that reason Mr. Freese has, since 1897, taken the shop foremen, etc., in with the office force; which accounts for the temporary drop of that year in the percentage to the salaries; this decrease was made up to the old office force by an increase in salary.

In 1889 Mr. Freese instituted a factory savings bank. Each person's profit share was entered in his passbook, but without in any way limiting the right of disposition over the amount.

A first glance over the table showing the workmen's shares with the average increase of 2.43 per cent. of the wages does not give much encouragement to the advocate of profit sharing, the less so in that labor agitations for wage betterments are for demands ranging from 5 to 20 per cent.

The chart shows the table figures plotted. Full lines connect the crosses that give each year's share; the horizontal full line is the total average; the dotted line shows the average trend. It is this latter line that is really illuminating and also rather encouraging in showing that the trend is decidedly upward. Such trend must, if in the long run borne out by results in other establishments, enlist the co-operation or at least the sympathetic consideration of workmen in general. As in Mr. Freese's plant the continued increase in the amount of the profit shares to the men was derived from a fixed portion of the gross profits, that meant an increasing gross profit as well, a compensating benefit to meet the views of the sane employer who



RELATION OF PROFIT SHARES TO SALARIES AND WAGES.

does not regard his shop as an eleemosynary institution. Mr. Freese says that his individual net profit increased in the eleven years by 268 per cent. and he "sees no occasion to be personally dissatisfied with the results." While the number of men employed increased from 114 to 255, the annual turnover grew by 167 per cent. Mr. Freese does not attribute the results simply to the introduction of the profit-sharing plan, but says: "I am certainly not inclined to underrate my individual work as owner and manager; but the relative division of the profits of 12.5 per cent. to the shop and office force and 87.5 per cent. to myself recognizes that sufficiently. I have found happiness in the community of interest with my co-workers and in the resulting peace. It is because my business success is based largely on this peace and good will that I am, in the general interest, desirous of aiding in the wide adoption of the plan."

A Triangle for Constructing Equivalent Geometrical Figures.

Jeremy C. Wiltmore, of Los Angeles, Cal., has recently patented a triangle by the aid of which a square may be constructed whose area shall equal that of a given circle, a circle may be constructed the area of which shall equal a given square, a straight-line may be drawn equal to the circumference of a given circle or a circle may be drawn whose circumference shall be equal to a given straight line.

To construct the triangle, referring to the diagram: On the diameter *a c* lay off *a d* equal to one-fourth of the circumference, erect *d b* and draw *b a* and *b c;* then *a b c* is the triangle, the angle *a* being 27° 36′ and the angle *c* 62° 24′, the angle *b* being of course a right angle.

To construct a square equal to a given circle: Draw the circle and the diameter *a c*, place the hypothenuse of the triangle on *a c* and draw *a b*, which will be one side of the square required.

To construct a circle whose area shall equal that of a given square: Place the triangle with its side and the apex of its angle coinciding with a side and a corner of the square, the other side of the triangle lying within the square, then draw *a c*, which will be the diameter of the circle required.

To draw a straight line equal to the circumference of a given circle: Place the triangle upon the diameter with the apex at *a*, draw *a b* and from *b* let fall a perpendicular *b d;* then *a b* will be one-quarter of the line required.

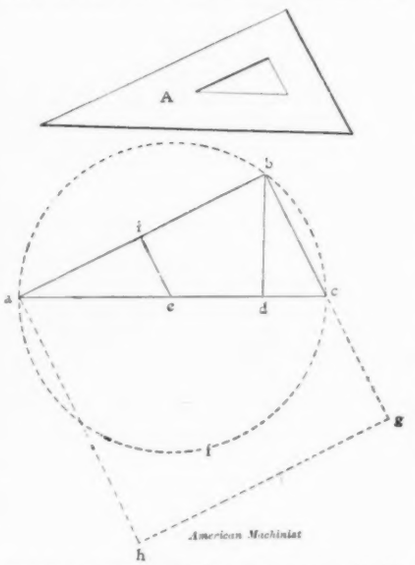
To construct a circle whose circumference shall equal a given straight line: Divide the line into four equal parts and lay the triangle upon it with the apex coinciding with one end *a* of one of the parts and erect a perpendicular *d b* at the other end of this fourth part, draw *a b*, bisect and draw the perpendicular *i e;* then *e* will be the center of the circle and *e a* will be its radius.

Echoes From the Oil Country—Moving to the New Shop.

The shop would have to be moved, that was a settled fact. The new building was getting along to where it was nearly finished, when considered as a covering for the work that was to be done inside, and for the people that were to do it.

We had known for a long time that the shop would have to be moved *some time*—indeed that was apparent from the time that the first work on the new foundation was under way. The general plan had been decided on. All that remained was to fill in the details and have the time come.

As the new works were to be some larger than the old ones, a larger gas engine than the old one was installed to make the wheels go round, and to help us move and keep running at the same time a new line shaft also was put in, the general plan being to move a machine at a time and get it set up and running. We were to start with the machines that could



TRIANGLE FOR CONSTRUCTING EQUIVALENT GEOMETRICAL FIGURES.

be spared the easiest, were to have a gang to do the moving, and another to do the setting up; in the meantime the rest of the men would be getting out the work as usual, either in the new shop or in the old one.

The two shops were about three-quarters of a mile apart, and the blacksmith shop was moved down first. By leaving one blacksmith to do the tool dressing, and by putting in a telephone in the new one, the work was not greatly interfered with. We also put a telephone into the new machine shop, and looked for things to go just as smoothly.

The first part of the shop that we wished to move was up stairs, and it had been a big job to get some of the lathes up there. We had been obliged to take them apart, and even then did not have any too much confidence in the beam that projected from the building. It had been put in when the shop was built, and it was not likely that years of exposure had done it any good. It was very clear that it would have to be strengthened before we would feel safe, and while we were at it we wanted to make it strong enough to hold the heaviest machines without the necessity of tearing them apart.

Of course all of the men knew that we were going to move, and any of them that cared to ask knew what was planned to go first, and they were doing some thinking themselves. It was no surprise when a man came up quietly with, "How are you going to get this stuff down stairs?" and the answer would likely be, "I've been thinking that it would have to go out of the front door there and down into the wagon that way. I don't exactly like the idea, and will welcome any suggestions that you have to offer. How would you do it if it was in your hands?" It was not long until there was a variety of plans proposed, and it was being seriously considered whether it was better to strengthen that timber, to take the legs off the lathes and slide them down the stairs, or to cut a hole in the side of the building and rig up timbers over an alleyway there and let them down that way, when a very simple plan was proposed.

I am not able to say to whom the honor of first speaking of it belongs, but after the idea was sprung that the easiest and best thing to do was to cut a hole in the floor, so that a wagon could be backed into the front door and the machines lowered directly on to it, it did not take long to measure the biggest machine and the place available, to see that it could be done. It was not much trouble to brace the timbers overhead and to make the floor safe, and soon the first machine came safely down through the hole, and that part of the question of moving was solved.

When a lathe is perched up on top of a wagon it looks somewhat top heavy, and when that wagon has to go over all sorts of roads for three-quarters of a mile, part of the way being along the side of a street that is being paved, the way that it sways back and forth on the good part of the way is not calculated to sooth the nerves when one thinks of the bad parts of it. Besides that, there were the machines to get ready to go, and they were to be put up into a gallery when they got to the new shop, and the shop was to be kept running all the time with the least possible amount of interference. It did not take me long to see that I was not even smart enough to do all the worrying that was necessary, to say nothing about the planning and the directing.

After moving a few machines it was very apparent that the quicker we rushed the entire shop down to the new quarters the better it would be, and I decided that I had some men that were just as competent to do some of the worrying as I was. I placed each foreman in absolute charge of the machines in his department.

He was to take down the countershafts, prepare each machine with all of its attachments for loading, and move it to a specified point. Inside of that range he was "monarch of all he surveyed," and no one else had any right or authority to give an order. Any additional help sent there was under him, no matter who they were or where they came from. If he could spare some of his men for work elsewhere they were entirely beyond his control when away.

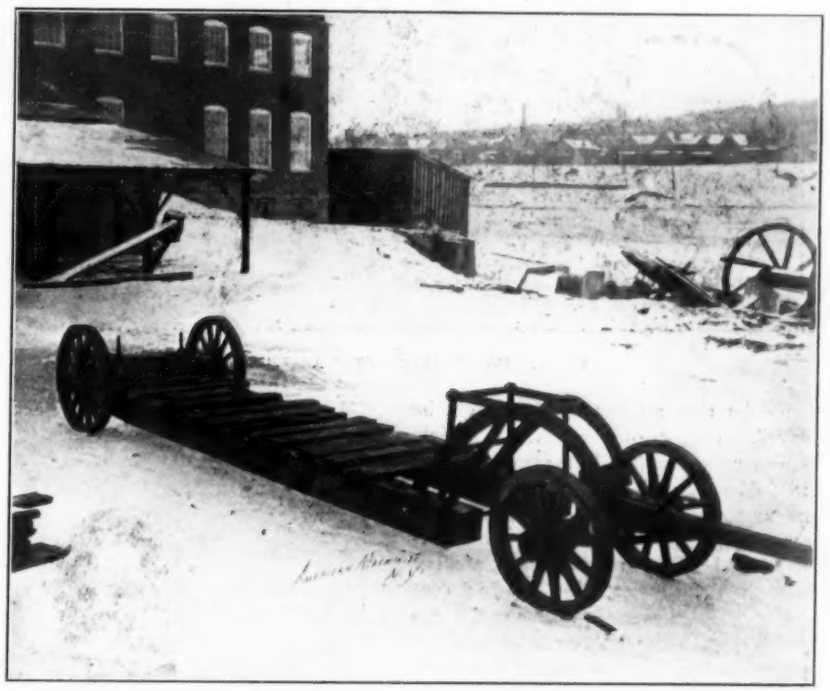
A man who had had a great deal of experience on outside work was put in charge of the loading, moving between shops and the unloading. His authority began when he received the machine from the foreman in the shop and ended when he had delivered it at a chalked location in the new shop. The draftsman had charge of the carpenters who put up the overhead work for the countershafts, and the foremen again had charge of the final setting of the countershafts, line shaft pulleys and machines in their own departments.

After a few machines had been moved, the man in charge of that part of the work came up with, "I've got an idea in my head that might save us some trouble, if it will work, and I think it will. I'll tell you about it anyhow, and then you can see what you think. You know that they are using a stone crusher to crush the stone for the new street, and it is down close by the new shop. They are not using the wheels that they use to haul it around with, and if you could get the use of them it would not be very much work to rig up some timbers for a bed and then we could get those machines down without any chance of their upsetting. I've been expecting to see wagon and all turn over the way that part of that road is. I don't see just how we can fix the front part of the wagon, but if you will come and see it we may be able to figure it out together."

I did not know how we could move machinery with a stone crusher, but I did know that we were taking some chances getting it over that road, and the hardest ones to move were yet to come; so I went down and we looked the wheels over and went over his plans. The result was the beautiful creation shown in the photograph. As the teamster drove through town with it, he was sarcastically asked how he chanced to upset, and whether he wanted any help to get straightened up again. At the shop he had to stand a fire of all sorts of fun. One man dubbed it "a stone boat with wheels on it." When the first machine was put on it and started away, its swaying around was not very reassuring, but a little reflection showed that upsetting with this contrivance was an entirely different proposition from that with an ordinary wagon with the load above the axles. All that was necessary was to make sure that the load could not tip without the wagon.

The bed was made of 8x10"x16' oak. By unscrewing the nuts from the bolts that came up through the rear axle, the back end of the bed would rest on the ground, and by tipping up the tongue the front wheels were removed and the front end also was let down. After the load was on, the operation was reversed and away it went. Of course it was so low that to get out of the alley, where we loaded the things from one part of the shop, we had to use rollers under it, and hitch a rope tackle to a convenient telegraph pole and hitch the team to the rope, but that made it easy for the team.

The only thing broken in the moving was a loose pulley that fell from a countershaft when it was being taken down, and a couple of small parts of two machines that were broken as they were being put together.



RIG FOR CARRYING THE MACHINE TOOLS.

For the facilities at hand the work was done rapidly. For instance, a 6½-foot Betts boring mill was taken to pieces, moved on rollers and trucks to the door, loaded and hauled to the new shop and unloaded in one day (and that day was Friday) without the help of a crane or anything better than a 3,000-pound hoist fastened to a beam overhead.

For anyone having to move a machine shop I can cheerfully recommend a divided responsibility, if connected in series, and the liberal use of a stone crusher. If the stone crusher is not at hand, one of your men may have an idea around his person that will do even better if you encourage him to let it loose.

For the purpose of getting the machines up into the gallery I had ordered two "Duplex" hoists with extra long chains, and they were slow in coming, but it didn't make any difference, as one of the men saw a crab, such as is used on a crane at a stone quarry, lying idle and suggested borrowing it. The owner was good natured and readily lent it, and a little skirmishing disclosed another good-natured man who had a rope that would suit the crab; we were able to furnish a rope of our own to snub back with and swing the machines clear of the edge of the gallery while hoisting them, and with the crab securely bolted to a column the rig was in good working order.

Things being so new and clean and nice, sort of makes us feel as though we had on our Sunday clothes on week days, but we are all proud of our new quarters, and with the same kind of help from the men that we had in moving we expect to make it the most desirable place to work in that can be found in this corner of the earth.

Some of the men already declare that it has the best fishing of any shop in the country, and they ought to know, for some of them may be found long before starting time with lines out trying to get the spring sucker, to say nothing of the boating and the swimming that they expect to enjoy later on.

W. OSBORNE.

When you file a brass or copper pipe with rosin to prevent its kinking in bending, you may find that after bending a certain distance the pipe seems to become much stiffer. The apparent stiffening is often due to the hardening or compressing of the material within, and if the pipe is warmed enough to soften or release the rosin it can then be bent with ease again. Copper pipes have been broken through a neglect of this precaution.

An Electric Grinder.

In reply to an inquiry from a subscriber for particulars regarding the home-made electric motor described at page 216, the author, Mr. F. C. Mason, supplies the following:

The drawings from which the engravings were made were not originally intended for publication, and from a technical standpoint they are not all that might be desired. Fig. 2 of the original article shows a cross-section of the armature, field and field core with the bonnets or armature supports left off. These bonnets must be made of brass or some other non-magnetic metal. The armature slots are not shown in this illustration. The field core is round, 1⅞ inches in diameter by 3⅝ inches long. The voltage is 110 direct current.

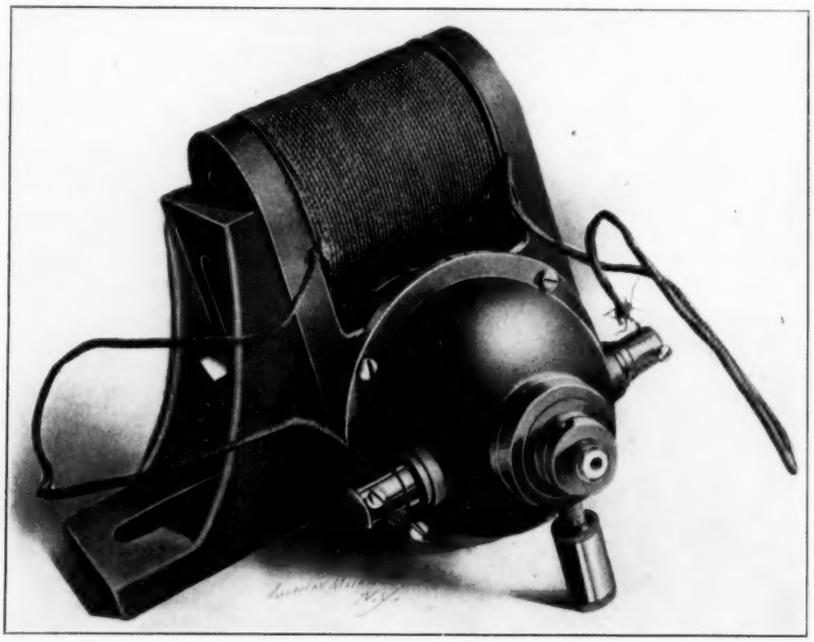


FIG. 1. HOME-MADE MOTOR ASSEMBLED.

The 24 gage metal of the armature disks is .025 thick; consequently a pile 2⅝ inches thick would nominally contain 95 plates. After shellacking or varnishing, the disks will of course be somewhat thicker and a few less will be required. For armature varnish I always mix ground asbestos with my shellac, using about one ounce of asbestos to each half pint. This improves the insulating quality of the varnish and keeps down the heat caused by the eddy currents in the armature.

The amount of No. 23 wire for the armature will be approximately 410 feet. As the winding is continuous and I wound from a spool, I of course did not measure the length.

The field spool dimensions are: Diameter, 3¼ inches; length, 3⅝ inches; bore, 1⅞ inches. Make the ends of the spool of fiber 1-16 thick and the tube of fiber 1-64 thick. Wind the spool very nearly full—say, within 1-16—and use the space left for the cotton cord protector covering. As No. 29 wire is .01135 inch diameter and the insulation will be about .010 thick, the external diameter, including insulation, will be about .021 inch. As the spool is 3½ inches between flanges, there would be 166 turns in each layer of the field winding if the winding were absolutely even. As the depth of the spool flange is 11-16 inch while 1-16 was left for the final covering and the spool tube was 1-64 inch thick, the space left for wire would provide for 27 layers. The extreme diameter of the winding being 3⅛ inches and inside diameter 1 29-32 inches, the mean diameter was 2½ inches, giving a mean circumference of 7.854 inches. The number of turns per layer, 166, multiplied by the number of layers, 27, multiplied by the mean circumference, 7.854 inches, would give a total length of 33,945 inches, or 2,829 feet.

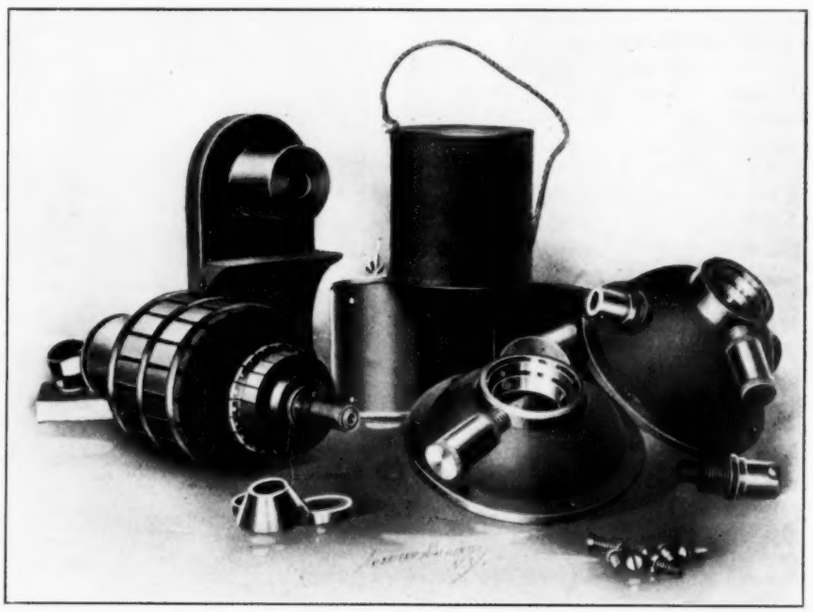


FIG. 2. PARTS OF HOME-MADE MOTOR.

Absolute uniformity in winding is not essential. If not wound evenly, the spool will hold a little less wire and the field will absorb more current, but this will have no appreciable effect on the running of the motor.

The discrepancy in the figures for the diameter of the left-hand cone shown in Figs. 1 and 2 was due to an oversight in checking. The correct figure is 1¾ inches.

The photographs enclosed were taken from a machine somewhat smaller than the one I described, but almost identical in design and construction.

The armature of this machine is 3 inches diameter by 2½ inches long. The complete machine weighs 15 pounds and will drive a 6-inch diameter wheel, taking any cut that the wheel will stand.

Annual Convention of the American Foundrymen's Association.

The annual convention of the American Foundrymen's Association is to be held June 7, 8, 9 at Indianapolis and on June 10 at St. Louis. Not only members but all interested in foundry matters are invited to send in papers or notes. The meeting will be a large one, and all are invited to bring their ladies, who will be specially entertained. It will be a good place for foundry and pattern foremen, and they also are invited. Special railroad arrangements will be made. For any information address Dr. Richard Moldenke, secretary, Box 432, New York city.

To write on glass or metals, use 1 to 2 parts of silicate of soda with 11 parts of liquid India ink. For white ink, 3 to 4 of silicate of soda and 1 of sulphate of borium.

Making Cam Patterns.

BY JOHN M. RICHARDSON.

Having been at one time in a locality where great numbers of cam patterns were made for automatic machinery, such as wire-forming machines, hook machines, etc., where in some instances quite a large number of cams would be needed on the same machine, all varying somewhat but each of the same general type, I will attempt to describe the practice as there employed.

Fig. 1 illustrates the style of cam I refer to, often called a face cam. When not over a foot in diameter these patterns are of simple construction, nothing being done, in the way of narrow strips or segments, to prevent warping and shrinking; for the castings are machined all over or very nearly so, and a liberal finish is left on the patterns.

Each pattern consists of three pieces of wood until after the lathe work is done: one for the hub and two for the body. The disks for the bodies are bandsawed from the plank and planed on one side on the buzz planer. The disk *a*, Fig. 1, is attached to the face-plate, and faced off to *x y*. Then disk *b* is screwed to *a*, and both pieces are turned as one. The hub *c* is of course separate, recessed into *b*, making a loose piece as it is cast in the cope. A templet, cut with scissors from very thin metal known as "button covering," accompanies the drawing and is the exact outline of the inner edge of the cam groove. This templet later goes into the machine shop, and is used there in laying out the shape on the blank former which goes in the cam cutting machine. The patternmaker places the templet in the right position on the face of the blank just turned, and holds it with a few fine wire brads. Wherever in the templet outline there is an arc of a true circle, the fine center point is still visible which was used in laying it out. This now comes in play as the position for the divider leg. The dividers are set, leaving a radius at least ⅛ inch greater for finish for the inner curves, and ⅛ less for the outer curves of the slot or groove. Wherever no true radius comes, set the dividers ⅛ open and scribe around the templet, then spread them properly for the other outline, and use as before. At least two brads must now be placed within the outline of *d*, long enough to locate it on disk *b*. The part *a* is still in one piece, and is next marked for replacing, and unscrewed from *b*, and the internal face of the groove in it is bandsawed and smoothed up. Usually a large part of the edge of *d* can be finished on the sandpaper disk wheel when one is available.

The body of the cam is now assembled in its former position, the screws and brads locating it, and this time it is fastened permanently, the place made by the saw blade being filled with a little spline. This completes the pattern proper, all except shellacking, etc.

A very cheap blank pattern, about ¾ inch in thickness, is next sawed out, the shape and size of the metal templet, with finish added. This makes the form to go in the cam cutting machine in the machine shop and is fastened to one spindle, and the cam itself is attached to another, while both turn in unison as the cutting progresses.

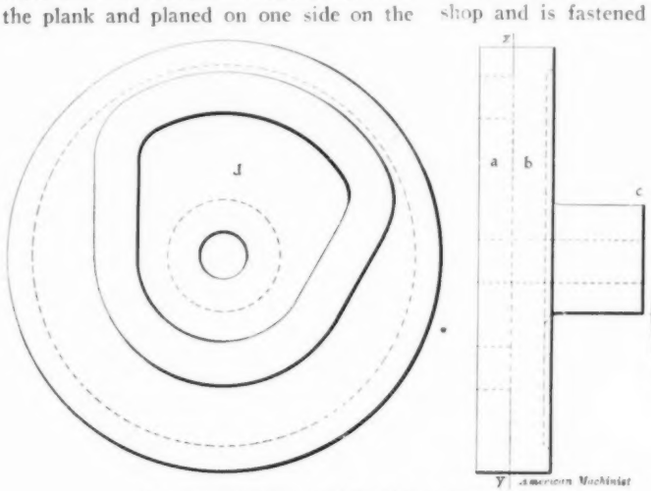


FIG. 1. MAKING A FACE CAM PATTERN.

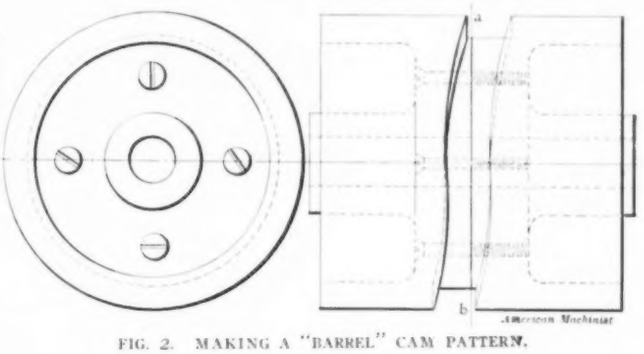


FIG. 2. MAKING A "BARREL" CAM PATTERN.

Fig. 2 shows a method of making the common barrel cam, having the groove cast in, which is sometimes adopted on cheaper grades of work. The pattern work consists of two separate patterns, the castings made from them being fastened together by screws on line *a b*. This allows the groove or slot to be cast without a core, and saves milling out the slot from the solid when a core is undesirable.

Cams made in this manner can be used with the cam surfaces just as cast, or they may be finished, according to circumstances, and this form admits also of taking up wear by facing off a trifle on *a b*.

An Engineering Dotheboys Hall.

The practice of paying tuition fees to proprietors of shops for instruction in various branches of engineering work as practiced in Great Britain, has been referred to in our columns, and a curious development of this is mentioned by *The Mechanical Engineer*, of Manchester, which says:

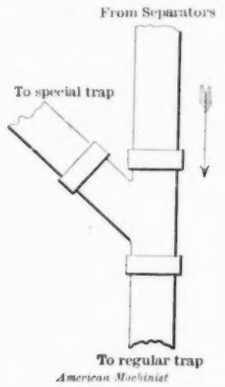
The importance of parents making full inquiries into the credentials of private persons or firms who advertise for engineering apprentices was illustrated in an action brought before Mr. Justice Darling, in which the plaintiff sued for the return of a sum of 40 guineas, which he had paid as a premium, and £40 which was to be returned to his son as pocket money at the rate of 30s. weekly. The defendant had advertised for a pupil to learn electrical and general engineering at a well-known "London works," to which he responded. His son, who had been for two years with Vickers, Son & Maxim, went to the "works" only to find that no business was being done, and that there was nobody there qualified to teach, nor was there any electrical engineering plant. His evidence as to his experience was amusing. Having nothing to do he amused himself with putting in window frames. There was, he said, "one engineer there, but he did nothing but smoke, and the pupil followed suit. There was also a blacksmith, who made pieces of iron hot for apprentices to hammer at." Another apprentice, called as a witness, said he had been at the works for fourteen months, and the only order he saw executed was when a little boy brought his hoop to be welded, and he came back again next morning because the parts had separated. This lad admitted that he was sent away from the works because of a fight between the pattern shop and the drawing office, when the pupils, having nothing else to do, threw pieces of wood at each other. The defendant, a Mr. J. H. Lock, claimed that his place afforded full opportunity for acquiring the information he advertised, and in answer to questions admitted 300 apprentices had passed through his hands, and that he had received about £10,000 in fees. The jury, however, evidently accepted the plaintiff's version, and gave judgment for the amount claimed with costs. The case is one which should be carefully noted by parents and guardians, and would-be engineers generally. The fact that the defendant admitted receiving 150 answers a week to his advertisement, and had drawn £10,000 in premiums, indicates the existence of an amount of credulity which we should have hardly expected.

Letters From Practical Men.

"Your Valued Favor Received"—Separator Drip.

Editor American Machinist:

For a long time it has been my intention to write about the ethics of correspondence, but neighbor Osborne, by some means of mental telegraphy, got his matter in first, and at page 313 has made his "Sammy" jump my intended claim. He has done it so well, however, that I am glad I did not "butt in" sooner. It is fair to presume that if I want to get posted up on corn shellers, so as to be able to intelligently advise the concern I represent what kind of corn sheller is the best for their agricultural department, and if I write to Osborne I will get by return mail a lot of literature on the subject, and it will be addressed to yours truly instead of to the firm whose stationery I am permitted to use. Now those above me do not wish to be bothered with letters or papers which they have done nothing to provoke; neither do they wish to be obliged to make inquiries of all departments to find out who sent the "valued



SAFE PIPING FOR SEPARATOR DRIP.

favor" that did provoke them. There is an easier way: The waste basket yawns for part, and the filing clerk is quite expert in getting the favors into their proper places under symbol letter, initial or whatever the system may provide for. I may have written to the Smith & Jones Company about their corn sheller, and the answer comes back to the concern, signed by "Brown, Secy.," and it gets into its proper box, Bo S1, or something. After a few days I may go to the office and ask if they have anything from the Smith & Jones Company. The S J C files are looked over and there is nothing found, and I drop them and Osborne gets the order for the corn sheller. I can't see that Osborne has any "kick coming"—that is, not now; but wait till it gets to be the Osborne Company, and when there are more typewriters than corn shellers on the plant. Then there will be a system, and some fellow who has begun to raise echoes in the hydro-carboniferous regions will get our orders for the shellers.

. . . . . .

A steam trap is supposed to be for the purpose of removing entrained water from steam at points selected for that purpose, and there is probably no place where it is as necessary to have this done effectively as on separators, for if the trap does not work, the separator at once becomes a very dangerous appliance. Under these circumstances water will accumulate till it gets high enough to be swept along by the passing steam; and as it will go intermittently, it is worse than a little flowing constantly. Having recently had a little experience in this line, I have put another trap on the drip above the regular one, and with its discharge open where it can be seen, so that if the regular one fails to take care of the water, the second one will, and by its open discharge also call attention to the other. Arranged with a "Y" as shown in the sketch, the extra trap will not fill as long as the regular one is operative. PETER H. BULLOCK.

The Heads of Machine Screws.

Editor American Machinist:

"Old Mechanic" at page 361 has hit the machine screw on the thread. Why did he not first hit it on the head? I have been devoting my spare time to perfecting a method for producing counterbores, commercially. After accomplishing this, the knowledge of standard screw head dimensions was desired. The best hand books were consulted, also several of the leading screw makers corresponded with and reasons for desiring information mentioned. One answered by stating that as screw makers never had come together on this point there was really no standard. Another very kindly mailed a line of samples the variation of the two No. 12's was .026 inch. The other makers are, I hope, "thinking it over," and I will value their answer when a standard is adopted. How pleasant to think of a .026 inch limit in this day, when so many dimensions are given in decimals and usually in four places! In other words, to be obliged to use a machined product having a greater variation than is found in cut-nails! Would not the introduction of a standard finished screw be welcomed, though at a much greater cost?

Lebanon, N. H. C. H. JENKINS.

[We don't believe the cost would be any greater.—Ed.]

A Turret Lathe Fixture and a Drill Jig.

Editor American Machinist:

The accompanying illustrations show a special fixture and drill jig designed for machining the bracket shown in Fig. 1 which was required in large quantities.

The bracket is first milled on the base, being held in the vise in the ordinary way, after which it is put in the drill jig, Fig. 2, to have the holes 1, 2 and 3 drilled, the other holes being bored on the lathe. The bracket is located centrally by the V-blocks *A*, being clamped against them by the swinging clamps *B*. The set-screw *C* is for locating the bracket parallel, so that the faces at each end of the large bored hole would true up when put in the lathe. The whole is clamped down by the two clamps *D*. The bush *E* is removable to allow a tap to go through, after the drilling has been performed, and has a spiral groove (not shown) cut in the body which screws on a pin in the outer bush to prevent *E* from working out while drilling. The cover *F* was made separate to allow the facings of the jig to be machined easily and was screwed to the body by cheese head screws, and located in position by a tenon, which made the whole practically solid. The four holes in the base of the bracket had the facings for the nuts machined after being taken out of the jig.

After the bracket is drilled it is put on the special fixture shown in Fig. 3, which was made to screw on the spindle nose of an ordinary turret lathe. The bracket is located on the four studs *A*, the bottoms of which are of the same diameter as the holes in the base, and is held down by the nuts and washers, as shown, the nuts being small enough to slip through the holes in the base and the washers U-shape, so that they can be slipped off after the nuts have been given one turn. Hole 4 is then bored and reamed with ordinary boring bars held in the turret and supported in the steady bush *B* fitted to the fixture. The boss is also faced with a tool on the cross-slide at the same time the boring operations are proceeding, after which the fixture is indexed around one-half a revolution and the boss faced on the other side. The indexing pin *G* is withdrawn by a rack and pinion motion operated by an ordinary box spanner. The diameters of the withdrawing pin and the outside diameter of the bush in the plate are the same, so that other plates made to suit the fixture can have the hole for the indexing bush reamed in position, through the hole for the pin.

After the large hole has been bored and faced both sides, the plate is indexed back one-fourth a revolution and the slide moved up to the stop *C*, which is accomplished by slackening the screw *D* and pushing the slide up by hand. This brings hole 5, Fig. 1, central with the spindle. The balance weight *E* also has to be let down nearer the center when the slide is pushed up, to insure the fixture being perfectly balanced in both positions. It is only necessary to slacken the two nuts *F* to accomplish this, when the hole is centered, drilled and finished bored in the ordinary way with tools in the turret.

The boring and threading of hole 6 are done at another operation, it being held on the plate shown in Fig. 4, which is bolted to the fixture shown in Fig. 3, after the other plate has been removed. The bracket is located by the large bored hole fitting a peg of the same diameter, and the base fits between this peg and the angle piece cast on the plate, giving the correct angle for the hole to be bored in relation to the base.

The bracket in this operation is also

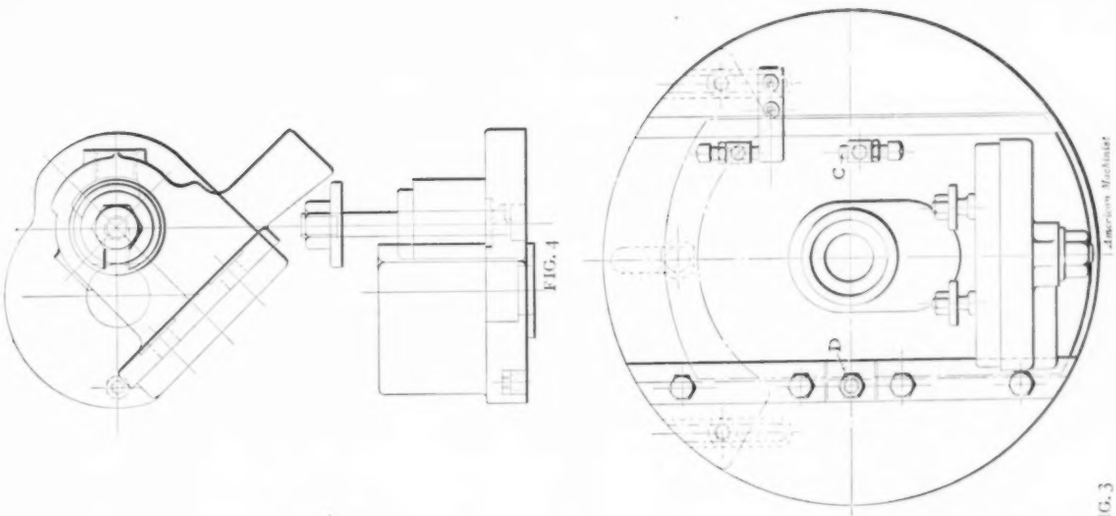
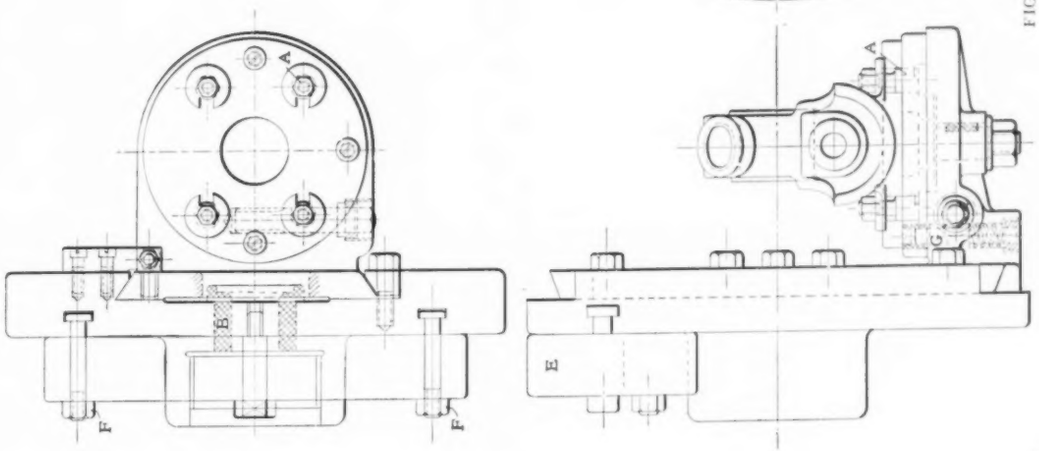


FIG. 4

FIG. 3



A PIECE OF WORK AND THE TOOLS FOR MAKING IT.

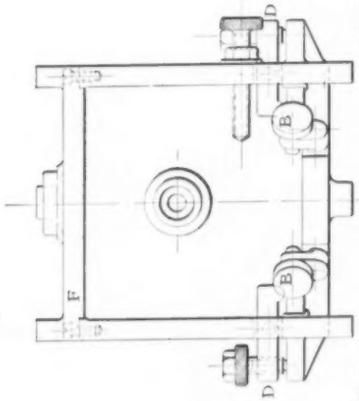
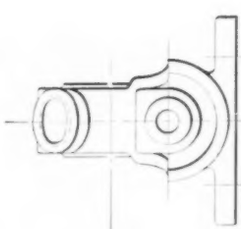


FIG. 2



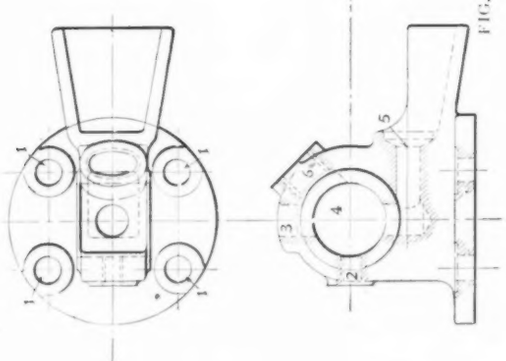
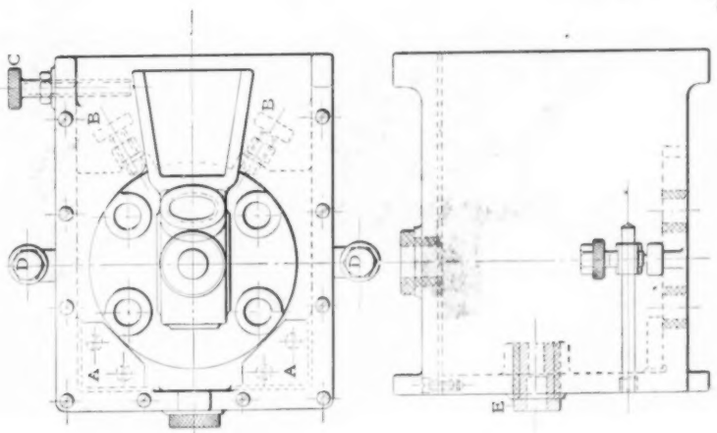


FIG. 1



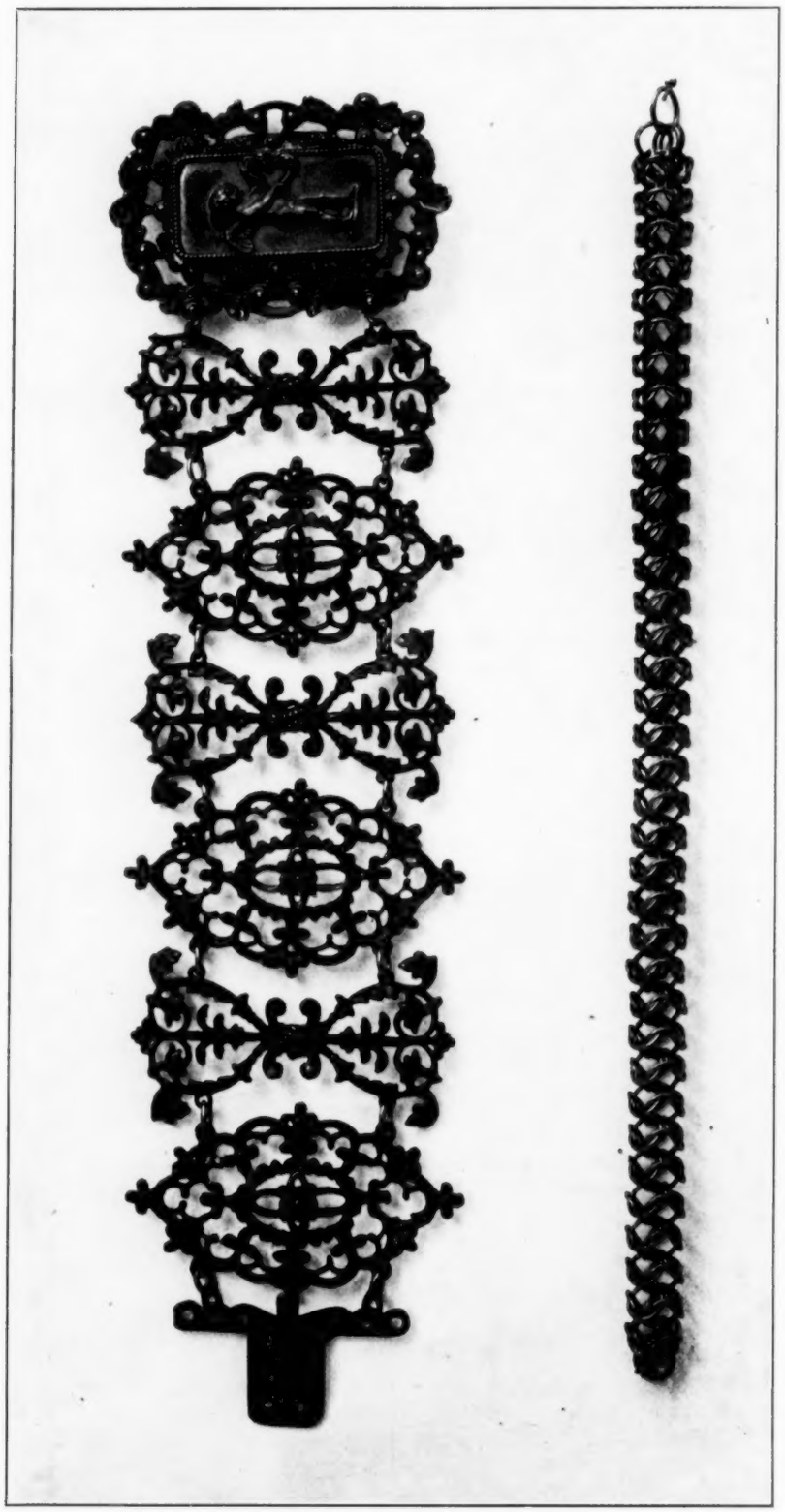
clamped down by a bolt through the large hole with a U-washer that slips off by giving the nut half a turn.

TIME SAVER.

A Cast Bracelet and a Chain With a History.

Editor American Machinist:

After the war which was brought to a conclusion by the victory of the Duke of Wellington and Blucher at Waterloo, in 1815, the German Government found itself with its treasury empty. The ladies of that country made the proposition to the government that they would give up their jewels to help the bankrupt country, if the government would replace these trinkets with ornaments of iron and steel made from the guns, sabres, bayonets, etc., spoils of war captured from the French. This the government agreed to do, and began the manufacture of Berlin iron jewelry, keeping the foundry running till the supply of guns, etc., was used up.



A CAST BRACELET AND A CHAIN WITH A HISTORY.

The bracelets here reproduced are fairly good specimens, left to me by my mother (I being the only machinist in the family considered them my lawful loot). They were in her possession for at least fifty years. The background of the cupid in the large bracelet is polished steel, as bright to-day as when it was made, nearly one hundred years ago.

The clasps are *brazed* to the cast iron, and the castings are quite soft and can be filed easily.

Should this meet the eye of anyone who knows something about the Berlin Iron Foundry, I think some information on the subject would be of interest to others than myself.

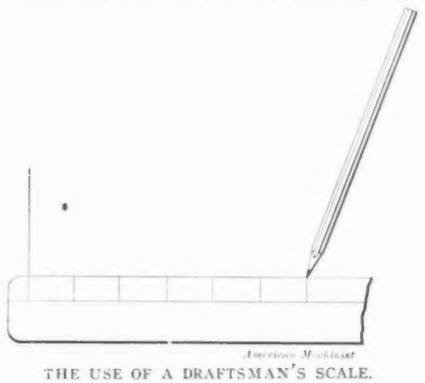
E. A. SUVERKROP.

Draftsman's Scales.

Editor American Machinist:

The article by Lewis F. Lyne, at page 318, certainly gives us many valuable hints on drafting; but I cannot agree with him on all points.

I do not think that his illustration, Fig. 5, represents the proper way to take measurements from a scale, as it gives too many chances for error. Let us follow the draftsman as he takes a measurement by this method. He must first see that the head of his tee-square is tight against the board, then he brings his triangle against the tee-square blade and moves it along until the edge of the triangle coincides with the line from which he is measuring. This latter operation is not always an easy one, as the light may be such that it casts a shadow over the line. Having done this, he butts the scale up against the triangle. He must now hold all three in place by his left hand and arm, while he lays off the required length with his pencil. This gives four chances for inaccuracy, while the old way—for this way is new to me—gives only two.



THE USE OF A DRAFTSMAN'S SCALE.

Perhaps Mr. Lyne may wish to know what the old way is, so I will try to explain. Referring to the accompanying illustration, he will notice that the first line on the scale coincides with the line from which the measurement is wanted. After

thus locating the scale, the pencil is run over the edge until the desired figure is reached.

Mr. Lyne's section liner is the most practical I have seen, and I shall make one right away. I also think that the idea of putting one scale, or at most two, on a rule is all right, and the only way to avoid confusion. CHIEF DRAFTSMAN.

Multiple Side-Punching.

Editor American Machinist:

Not long ago we received quite a large contract to furnish the parts for a railroad lantern, and the necessary tools and dies to make these parts accompanied the same, which latter was the largest collection of "junk" I had ever seen.

Our instructions were to use as many of these "tools," etc., as practicable, and to replace or remake any tool that we thought unfit for the purpose.

One part of this lantern, called the "lower guard shell," was made of IX tin, 3½ inches diameter by 2¼ inches deep, and had six rectangular holes 3-32 inch wide by 9-32 inch long, located on the side ⅞ inch from the top or closed end of the shell. These were supposed to be an equal distance apart, and to aline or connect with a steel ring that had six notches into which was locked the guard or frame.

The tool furnished to punch these holes was a mean affair, built on the ratchet plan, which punched each hole separately, operated by hand, and supposed to lock against a pawl, in punching each hole. There was no attachment to prevent the shell from slipping on the band, and it was an utter impossibility to punch the holes regular. It was finally decided to abandon the tool entirely and to build something or other to punch all the holes at once.

I decided to build a tool which, instead of having six legs or pushers, one for each punch, as is usual for a die of this sort, and also the spring for each punch necessary to pull the punch out of the shell after being punched, had only one leg used in connection with an oscillating ring which furnished the movement for all six punches. This arrangement brought the die proper away from under the ram of the press and obviated the possibility of the operator being injured in accidentally tripping the press before removing his hand or fingers.

The die itself consisted of a gray-iron bolster *A*, which was faced off on the back and a thread cut into same to fit on the dividing head of the milling machine. This bolster was then screwed on to a "boss" chuck fitted to spindle of a lathe which had the same thread as the milling machine head, and was turned like the sketch, which brought the top surface of this bolster slightly above the slots in the die (when in position), a groove or circular channel *C* was turned deep enough for the thickness of the punch, 5-16 inch, and of the oscillating ring, ½ inch, or 13-16 inch in all. A seat *F* for the gray-iron die plug was also turned to a suitable depth and diameter, and also a clearance for the shell, as at *G*. This bolster then had six radial slots milled in it ½ inch wide by 5-16 inch deep for the punches *L*.

A gray-iron die plug *I* had a thread cut into it to screw on the dividing head, and it was turned on the boss chuck to just allow the formed shell to slip over it, and it was finished to the proper hight. Then six holes ⅞ inch from the top edge and 5-16 inch diameter were drilled in the same in the milling machine, and also counterbored to ½ inch diameter by ⅜ inch deep for the steel die bushings, as at *J*. This plug, though ready, was not fastened at this time to the bolster.

Six steel bushings ½ inch diameter by ⅜ inch long had the desired size of hole, 3-32x9-32 inch, worked into each perfectly central and these were hardened and driven into the counterbored holes in the gray-iron die plug *I*, the projecting edges being ground off to conform to the diameter and shape of the plug.

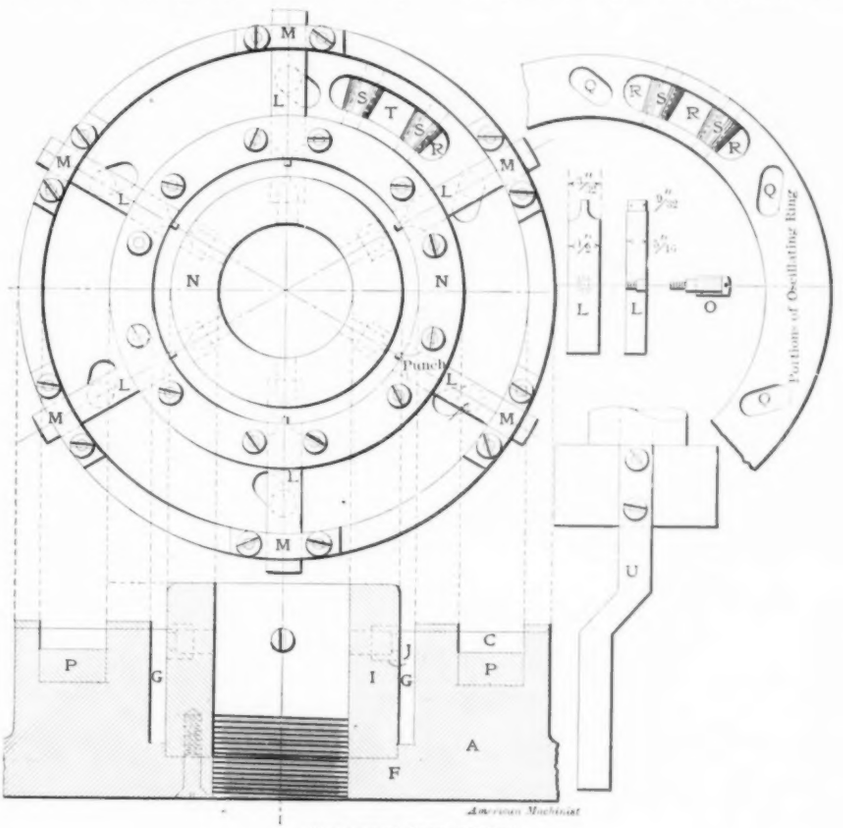
The six punches *L* were made of tool steel and milled to fit into the six grooves or slots provided for them in the bolster, and after *one* punch had been milled to fit and enter into one of the dies, the plug *I* was permanently secured to the bolster from beneath by three flat-head screws and dowel-pinned. Six short straps *M* of cold-rolled steel 3-32 inch thick and fastened with flat-head screws were placed over the slots at the outer ends to keep the punches in position. Another circular strap *N* secured the inner ends. The other five punches were then fitted to their corresponding die. Each punch had a hole at a certain point, counterbored half way through and tapped the other half, into which was screwed a stud with roller *O*.

The oscillating ring *P*, made of machinery steel, had six oblique slots *Q* milled into it which engaged the rollers on the punches, and when the ring was moved each punch moved backward and forward ¼ inch from one extreme of its travel to the other. Another slot *R*, ½ inch wide by 1½ inches long, was milled as in the sketch, and two hardened taper rollers *S* were so placed that the near sides of them were parallel as at *T*. The die was then ready to assemble.

The punch or leg *U* which operated this ring was made of tool steel like the sketch, the "knee" so machined as to go between the two rollers in the ring. This was fastened to a punch-holder with two flat-head screws and attached to the ram of the press.

On the downward movement of the ram this leg enters the space between the rollers and a square hole in the bolster immediately under acts as a guide, and as the taper knee engaging the rollers in the ring forces or turns the ring, the oblique slots in the latter operate the punches. These punches are so made as to length that only two punch at a time. On the upward movement, when all the punches return to their original positions, the punched shell is readily removed.

This die was originally made as an ex-



MULTIPLE SIDE PUNCH.

periment, so that in case of any trouble in the action of the various parts, in there being too much friction, etc., the same could easily be changed; but up to date over 20,000 of these shells have been punched without any trouble.

A. C. R.

An Equalizing Expansion Chuck.

Editor American Machinist:

The accompanying sketch shows a special chuck which I recently designed for turning phosphor bronze shells, used as valves for air compressors. Shells of average size are shown in Fig. 1. The valves were turned to fit a collar gage and faced on both ends, the hole being left rough. The problem was not a very easy one, because the cores were not uniform. Some were fairly straight and round, but the majority were tapered, leaving a wall of only 7-64 thickness at the front end after turning to size.

Fig. 2 shows the chuck. The flanged body *a* was made of cast iron and secured to the turret lathe chuck or face-plate by means of four cap screws, though, if preferred, it might be made to screw directly on the spindle. Cams *b* are tapped with right- and left-hand threads and are operated by screw *c* and rod *d*, which extends through the entire headstock spindle and is guided in the rear by the knurled knob *e*, the front end of which fits the spindle hole. Jaws *f* are a sliding fit in body *a*, and through springs *g* are held tightly against the surface of the cams *b*. Collar *h* is threaded to fit the body *a* and acts as a support for the adjusting screw *c*. When the screw *c* is operated, the cams *b* are kept from turning by the pin keys *i* and keyways *j*. Safety stop-screw *k* prevents the cams from becoming disengaged from pin keys *j*.

The action of the chuck will be plainly seen by a glimpse at the sketch. If, for instance, the front jaws should first come in contact with the work, a very slight pressure on them will move the screw and other set of cams and bring the second set of jaws in contact, the pressure being equally divided.

The chuck has done very good service. The tendency to spring the shells out of round can be overcome by using very light pressure when taking the finishing cut.

G. B.

Getting Advertised Matter.

Editor American Machinist:

At page 313 Mr. Osborne vividly describes Sammy's experience, with its surprises and disappointments, in getting answers to his mail inquiries, and at the same time, between the lines, Mr. Osborne gives the non-sender of the desired information a sharp rap over the knuckles, although it is doubtful if he gets in a solar plexus blow.

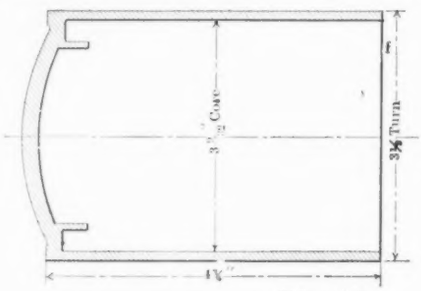


FIG. 1 Valve

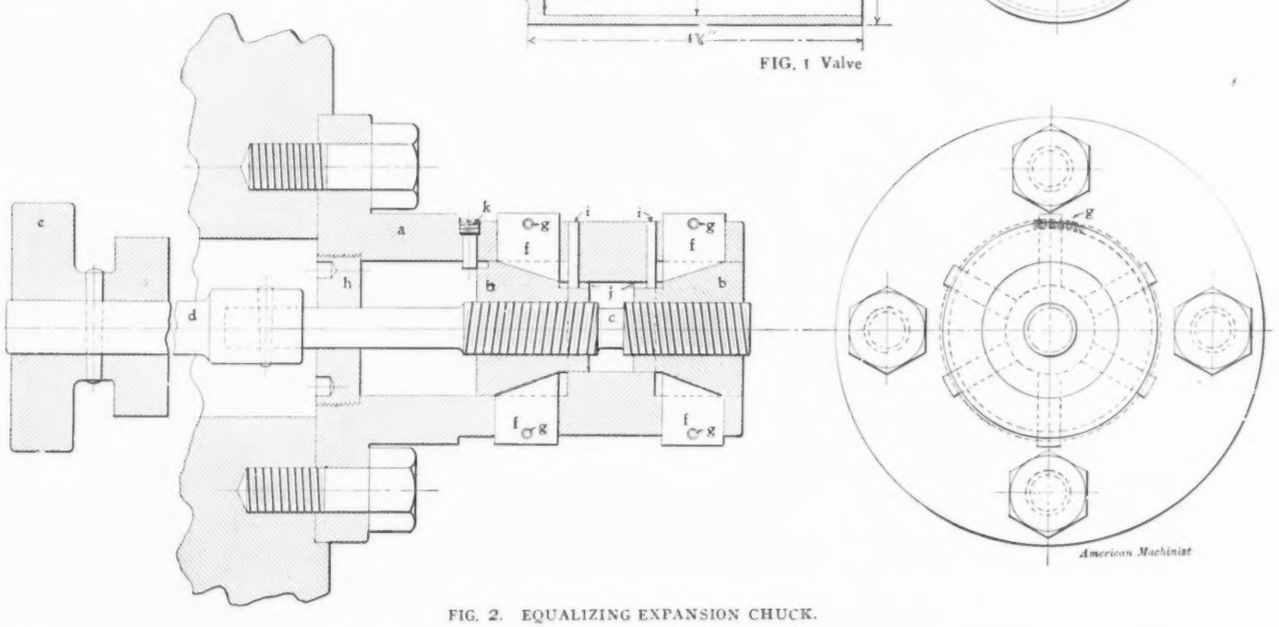


FIG. 2. EQUALIZING EXPANSION CHUCK.

In his graphic delineation, however, Mr. Osborne fails to mention two familiar types of experience in getting information by mail inquiry. I have no doubt but that Sammy had some experience with one, and perhaps both, of the unsatisfactory features of obtaining the desired information; I certainly have had them. Many ads. have the phrase, "Booklet yours for the asking," and in quite a number of instances the writer has been led into asking for the "booklet," which is supposed to tell, perhaps not all, but quite a lot about the machine, fixture or method that is advertised, only to receive in return a pamphlet full of high-sounding testimonials and an elegant creation of the printer's art, but, save for a small cut of the machine supposed to be fully described, absolutely barren of interest, and a delusion and a snare, and after receiving several of the barren kind and only one of the kind one would welcome and gladly give a place in the files, I have begun to look with suspicion upon the ad. that has the legend, "Booklet yours for the asking." Even the testimonials themselves often fail to reveal, or even suggest how the firm in whose possession the tool or fixture may be, use it, what machine or tool it replaces or what the output is as compared with that of a standard machine or tool.

It is possible there is certain method of madness or design in sending out literature to the trade that only aggravates and consumes time, with the expectation that it will be followed up with a more definite request or will give the sender an opportunity to have his representative call and read aloud the testimonials that the book contains. That brings us to the second and often annoying feature of listening to the parrot-like talk of the glib young man who, in about thirty seconds or less, has made his listener feel like "thirty cents," or showing him the door.

Quite recently I was called on by a beardless representative, who proceeded at once to take by storm any and all things that were opposed to his argument, and in doing so endeavored to set at naught the

major portion of fifteen or twenty years of machine-shop experience. At first his graphic description was fairly interesting, but upon passing from the novel and new to the commonplace and old, his remarks became flat, and when the argument turned to criticism, derision and contempt for existing machines and methods, the worm turned. Instead of using a sudden outburst of stored energy and bursting the door off its hinges, I invited the beardless stripling to pass his opinion as to how several of the operations which were submitted should properly be performed to get the best and quickest results, and, when driven to the last ditch, my caller was forced to admit, at least to me, that his errand was an entirely fruitless one. The unsatisfactory part of the whole interview was that it was the young representative, and not the Old Man, who received the most punishment, as it is almost, if not quite, impossible to properly thrash the Old Man over the shoulders of his representative. A good bluff may be all right if it works, but the good buyer is apt to shy a little at a new and, to him, untried proposition; he prefers to see the machine set up and see it turn out the goods. So thinks THE BUYER.

A Boring and Tapping Rig.

Editor American Machinist:

Finding myself out of a job, one day I drifted into a small job shop in Syracuse, and found a lot of 6,000 iron castings like Fig. 1, called "bodies," to be bored and threaded 4 inches diameter. After a little chat with the proprietor, I retired to the hotel and during the evening devised a way to do the work. The next morning I took a contract to design and make the necessary tools to bore the castings and cut the threads at the rate of 200 in one day by one man. The proprietor, in return, contracted to pay me $2 per hundred, and also to furnish an ordinary engine lathe and power.

There were only four tools required. First, the reamer, Fig. 2, was screwed on to the live spindle. Second, the back face-plate, Fig. 3, was slipped on to the tailstock spindle without the center. Third, the cast-iron yoke, Fig. 4, having a 3-foot bar of round steel screwed into each end, was held at one end loosely between two solid parallel bars or beams fastened on the wall behind the lathe, and a sort of a saw-horse on the floor in front of the lathe took the other end, this being set so that the center of the yoke hung in the center of the lathe.

Now my tools are all in position, and I have a large pile of the bodies within convenient reach. I place a body in the yoke, allowing the two lugs *D* to slip into the slots *D* in Fig. 4, the main part of the body going through the opening in the yoke, there being about ⅛ inch leeway all around between yoke and body, thus engaging the sides of the body and leaving both ends free.

The large end of the body is then made to enter the opening at the front end of the back face-plate on the tailstock. The screw, being fitted with a hand-wheel to allow rapid handling, is then turned and forces the open end of the body over the hog-nose reamer and up until it reaches

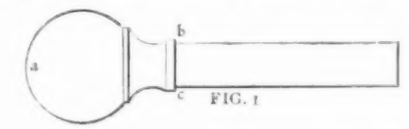


FIG. 1

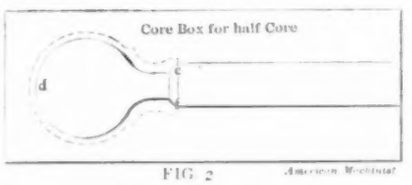


FIG. 2 American Machinist

LONG STEM CORES.

the cutter C, which brings the size of the hole correct and ready for the tap, this cutter *C* taking off the scale on corner, as indicated at B, about ⅛ inch back, which greatly prolongs the life of the tap. The tailstock spindle is then backed off, the body is taken out and laid aside and another one is put in, and so on until several hundred are bored.

Then the reamer is taken off; the tap, which is made on the same plan, is put on to the spindle, and a like performance is gone through with them all, except that when the tap has run in to a certain mark the lathe is reversed and the tap is backed out of the casting, the tap being made solid.

With these tools on an ordinary engine lathe I reached as high as 300 in ten hours, bored and tapped complete, which I called a good day's work. After completing quite a number of the pieces, I sold the tools to the proprietor and resigned.

Since that date I have learned about the collapsing taps, which would have increased this output about 25 per cent.

H. E. WOOD.

Long Stem Cores.

Editor American Machinist:

By this term are meant, of course, those which project away from the pattern impression horizontally and are supported or held in position at one end only, as here illustrated. In Fig. 1 we have a brass knob *a b c*, whose inside is to be hollowed out as indicated in Fig. 2, *d e f*. This may be considered an easy task, perhaps, but it is not so easy as one might at first think. Two things must always be kept in mind when providing for such a core: (1) It must be kept properly balanced in the mold to prevent its toppling over; (2) it needs to be kept firmly in place to prevent either sagging or rising, otherwise the metal will not be of uniform thickness all around. These two requirements can be easily secured by making the print on the pattern uncommonly long. In this way the weight of sand at one end will coun-

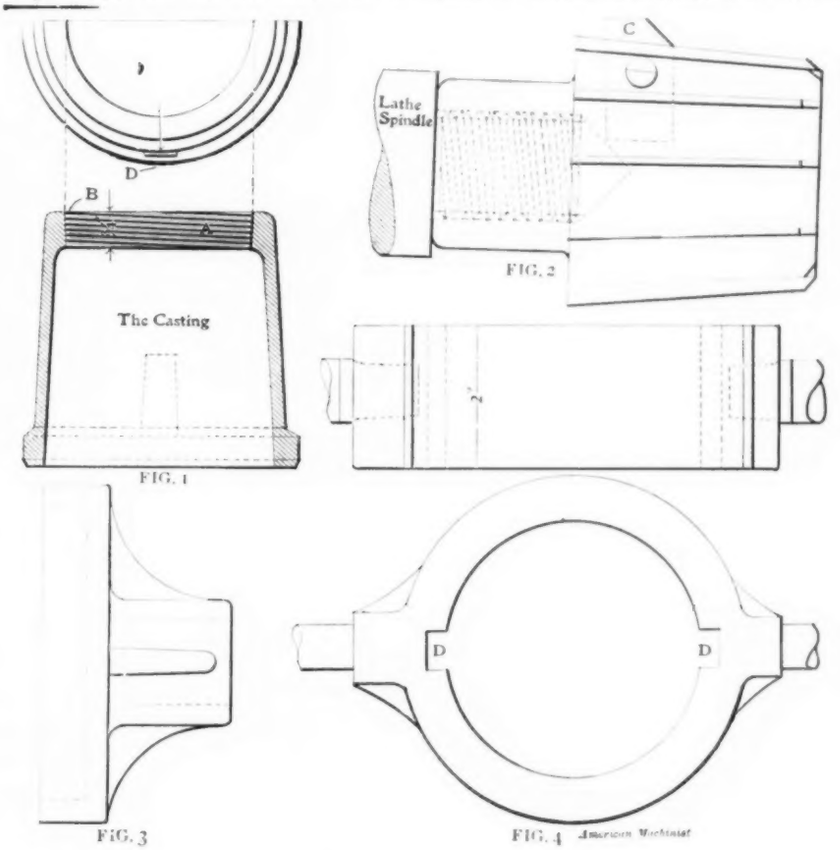


FIG. 1 FIG. 2 FIG. 3 FIG. 4 American Machinist

BORING AND TAPPING A SPECIAL CASTING.

terbalance the projecting core at the other, as well as imparting rigidity to it. Usually, where there are two or more supports to a core, the prints are made short, and they answer every purpose when thus made. But in the case of a single support that would not do at all, for the very obvious reason that the projecting end, outbalancing the support, could not very well be kept in proper position. To avoid all such trouble, a long core print, as shown in Fig. 1, with a correspondingly long corebox, Fig. 2, will answer every purpose.

HOMO.

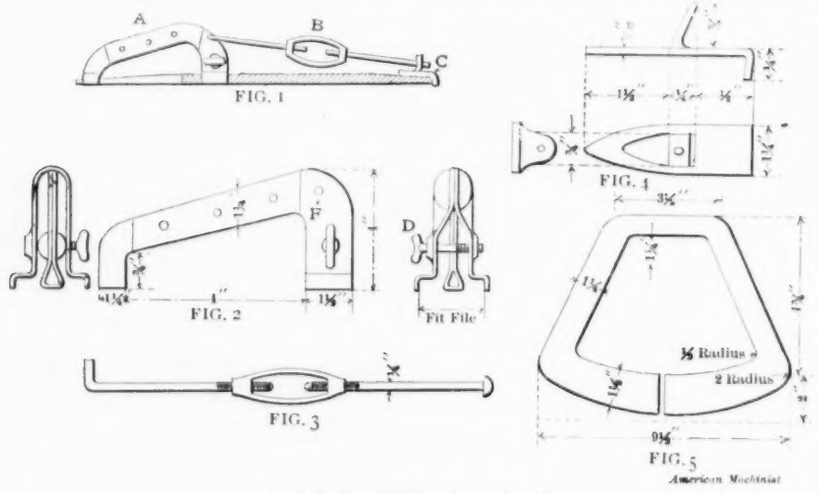
A File Holder for Surfacing.

Editor American Machinist:

The sketches show an improved offset file handle for filing large surfaces. I saw it recently in the kit of an English machinist, and I was not long in getting up one for my own outfit. The idea is not new, the Nicholson File Company having one somewhat similar illustrated in their "File Filosophy."

In Fig. 1 the handle *A* is made of 1-16 inch spring steel, formed on one end to fit the tang of the file, and on the other into a clamp which embraces the sides of the file and is tightened thereon by the thumb-screw *D*, Fig. 2. A piece of wood is secured to each side by through rivets forming a comfortable knife handle grip. The turnbuckle *B* (which, by the way, can be bought at any hardware store as part of a bucksaw) and the clip *C* complete the arrangement.

The clip *C* for the "point" of the file can be cut from a piece of ⅛-inch or 3-32 inch soft steel sheet and a tongue cut out and turned up in the manner shown in Fig. 4, a hole to be drilled in it to be an easy fit for the button-headed end of the turnbuckle, which is passed through it, as shown in Fig. 1. At *E*, Fig. 2, a small brass boss is soldered on to form a bearing for the threaded end of thumb-screw *D*.



A FILE HOLDER FOR SURFACING.

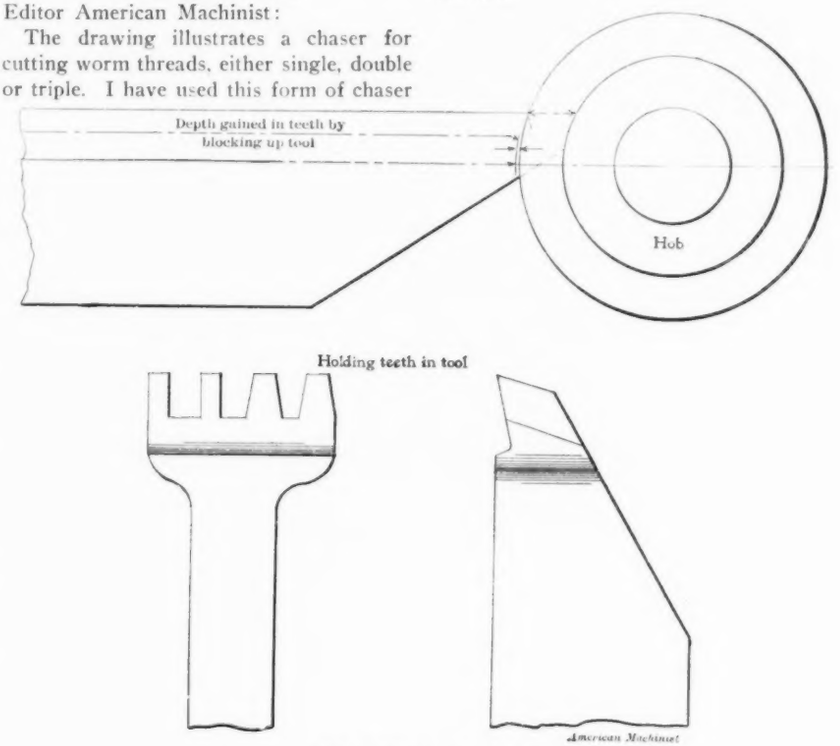
The dimensions given at Fig. 2 will, with the development at Fig. 5, enable one to cut the spring steel stock economically. It is possible to put quite a curve in a file by setting up on the turnbuckle. The dimensions shown will fit either a 14-inch or 16 inch file. At *F*, Fig. 2, is a hole which fits the hook on the turnbuckle rod, the length of which rod is only suitable for one length of file.

C.

Worm Thread Chaser.

Editor American Machinist:

The drawing illustrates a chaser for cutting worm threads, either single, double or triple. I have used this form of chaser with great success, and although chasers are by no means new I believe some of their possible forms are very much neglected, as being obsolete, when in reality they are great time savers if properly constructed. I use them with a great deal of satisfaction, not only upon worm threads, but also for various other forms of threads.



WORM THREAD CHASER.

For worm threads I use a roughing and a finishing chaser. The rougher when being formed is blocked up in the tool-post and the hob is driven on an arbor between lathe centers, the lathe being geared properly for the lead of the hob thread. The chaser blank is then gradually fed against the hob, similarly to ordinary thread cutting except that the hob does the cutting, until the full depth of tooth has been reached.

It is obvious that the chaser being cut upon a line above the center of the hob, the chaser teeth will be deeper than the teeth of the hob, but of the same width.

The finishing chaser is made similarly, only it is hobbed with its upper surface but slightly above the center of the hob, thus causing the teeth to be very slightly deeper than the hob teeth.

The sides of the teeth are then chipped and filed or ground for clearance, leaving the tool shaped as shown. The first two teeth at the left cut at the ends only, while the two at the right cut only upon the sides. The finishing chaser does not really require the end-cutting teeth, as this tool is intended to take only a few light cuts, but I generally provide the end cutters, as it is not much trouble to do so and they are very handy in case it should be desired to cut a little deeper.

It will be seen that the first chaser having cut the worm to proper caliper depth, the teeth of the chasers have not been fed their full depth into the work, thus leaving the threads of the worm thicker than they should finish. The second chaser is now fed to the caliper depth obtained by the other chaser, and taking a few light cuts accurately finishes the worm.

The roughing chaser, doing the heavy work, will wear somewhat upon its corners; but the finish chaser corrects all

errors, and will be found to make a very smooth job, and give the right amount of clearance at top of thread.

This chaser has the advantages of being easily and correctly made, and easily set for cutting; it cuts rapidly upon all four teeth at once, largely obviates the "fat" thread common with the single-pointed tool, at the exit of the tool, and the worm is cut correctly as the chaser teeth have the same shape as the teeth of the hob used for cutting the worm gear. The chaser shown is for cutting a double-threaded worm. C. B. C.

Another Section Liner.

Editor American Machinist:

I enclose a sketch of a section liner. With a pin in the outer triangle for a stop and an eccentric washer fastened to the inner one there should be no time lost in adjusting the triangle to any width. The two holes are for the fingers and assist in holding and moving the device.

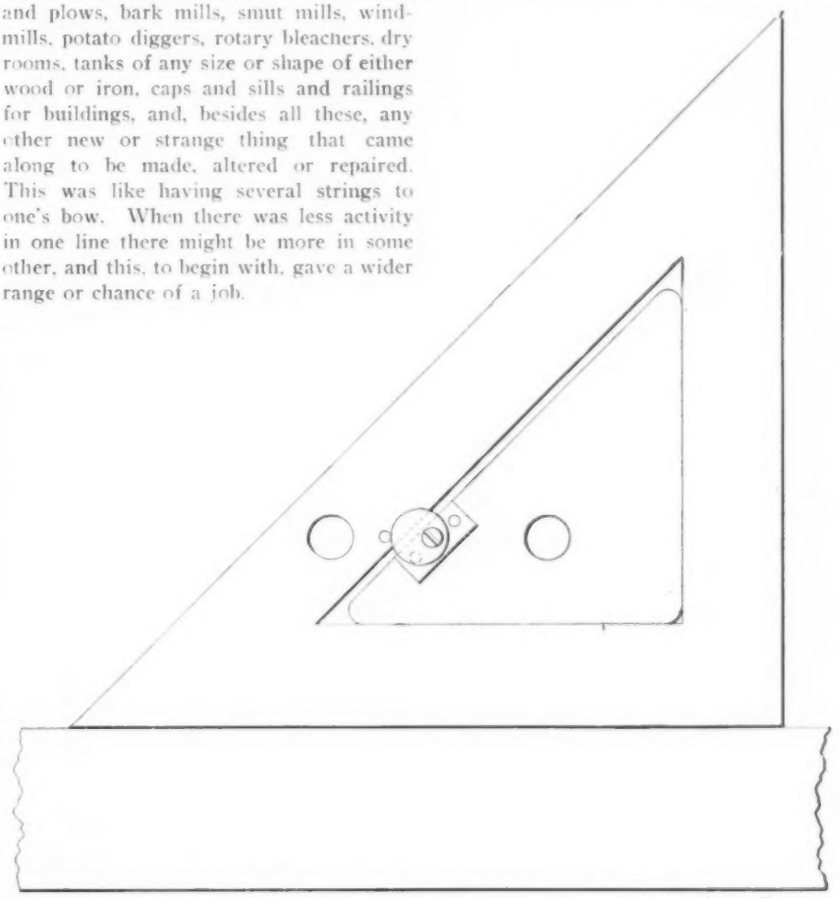
O. F. Paul Spitzel.

Unsteadiness of the Machine Trade.

Editor American Machinist:

There is one phase of the development of machine manufacturing which I think has been little spoken of, but which is deserving of quite serious and extensive consideration, and perhaps never more so than just now. We are familiar enough with the magnificent progress made in recent years in productive capacity and in precision and reliability of product, and over our success as so evidenced we have been naturally and properly exultant. Remembering after all the ultimate purpose of most of our activities, that of securing to the workers—including always the organizers, directors and all necessary co-operators—the reliable and constant means of comfortable life support, we have to at once question the reality and the extent of our progress. The machine manufacturing business in most of its branches has not become more reliable for our livelihood with the advancing years. Indeed it would be quite easy to show that in some respects we are more precariously conditioned than in "the days before the war." We seem now to be almost without a governor, or perhaps our gait may be likened to that of a steam engine when the governor belt slips. We may seem to be running along steadily enough for a time, and then we begin to go faster and faster; but, generally quite suddenly, though sometimes more gradually, our speed drops and we find ourselves creeping when we should be running. Even now there are few who are unable to count the fence posts along the roadside. We know that by and by we will be going faster again, but that does not make us any more satisfied with the dragging present.

It is a curious thing that the very arrangements which have most promoted our present facility, rapidity and cheapness of production have brought with them a tendency to promote, if not to produce, these irregularities in the running of our industrial machinery, these uncertainties of constant and steady and profitable employment for the workers. It may be well for us to look back a little and to recall the conditions under which machine shops and their allied industries were operated in the years when our present elderly men were boys in the shop. In those days the shops generally had not become specialized. Practically every shop was ready to make almost anything that was to be made of iron or steel or brass, or even if largely of wood. One shop within my knowledge built steam engines and cooking stoves, sawmills and laundry equipments, dredges and plows, bark mills, smut mills, windmills, potato diggers, rotary bleachers, dry rooms, tanks of any size or shape of either wood or iron, caps and sills and railings for buildings, and, besides all these, any other new or strange thing that came along to be made, altered or repaired. This was like having several strings to one's bow. When there was less activity in one line there might be more in some other, and this, to begin with, gave a wider range or chance of a job.



ANOTHER SECTION LINER.

Then, again, in those days every shop quite largely made its own tools. Practically all the small tools which are now made in factories and kept by supply houses were then made by the individual shops to suit their own precise needs. The making of all these tools gave the shops always something to do when the outside jobs gave out or slacked up. When the shop was busy with its general run of work the supply of small tools would be neglected, and sometimes would be so run down that the foreman would be hoping for a little let-up, so that he would be able to stock up again. If times got quite slack and the boss had sufficient means to see him safely through, the shop would be quite likely to be making some of the larger tools such as we now invariably buy from the machine tool builders. I remember how flat things dropped after the panic of 1857, and I know a 36-inch lathe, still in existence, that we built throughout among other things in the winter that followed. The patterns were made and everything was done in the shop. The lathe, although embodying no striking novelty, was in many respects a better lathe than any in the shop before that, and when business began to pick up the shop was better equipped by one lathe. Many machine tools and many improvements upon machine tools had their origin years ago in the determined efforts of the shops to tide themselves over the slack spells. What might have been stumbling blocks became stepping stones to higher things.

Besides all the tools, little and big, to be made, which we make for ourselves no more, there was also the line of machine parts which are now factory made; bolts, nuts, studs, set-screws and such things were all then made by each shop for itself, and the making of them involved vastly more work, or at least took much more time, than it does now. For instance, there was a time when there were no factory-made nuts or even nut blanks. I have seen thousands of hexagon and square nuts for engine work bent up and

welded and shaped by the blacksmith from bar iron, and I have done my full share of tapping and facing and milling or "slabbing" them to shape and size and then filing and finishing them.

This suggests a vast amount of work which came in to fill up and to equalize the gait of the shop and to carry things along at a more even pace. The times which now are utterly profitless would once have been used to anticipate and to prepare for the work s re to come in the near future, and for the work done in such times the profits were simply delayed and not lost.

What can we do when we have nothing to do? The old way was to originate, and the man of initiative was never more wanted than now. It is not to be believed that in the matter of steady work there is any necessity for us to be getting worse instead of better. It is only for us to find out what to be doing.

TECUMSEH SWIFT.

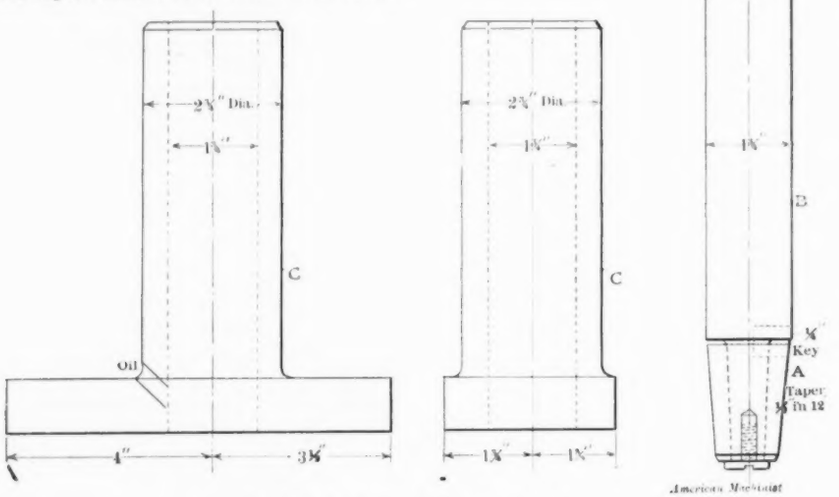
Locating Holes For Bushings In Jigs.

Editor American Machinist:

Locating holes for bushings in jigs and drilling templets, when the work cannot be done in the lathe or universal milling machine, may readily be done on the bench or in the vise by the method here shown. It may not be new or novel, yet a trial will show its worth.

It is our custom to use hardened steel bushings, lapped true in the bore, ground taper on the outside to suit holes in the jig and driven in tight. In some few cases we use loose, straight bushings, but as the wear in the jig in time is considerable we generally prefer to have them fit tight.

We lay out the holes for the bushings and drill with reasonable care, and to a size suitable to allow the point of one of the taper reamers *A* to enter. The reamer



REAMER AND GUIDE FOR JIG HOLES.

is fitted on a shank *B*, and is driven by a key as shown. We use the casting *C* for a guide, the bore of which is made a nice running fit to suit the body of *B*. The bottom of *C* is faced square with the bore, and is of certain dimensions relative to the center of same. By securely clamping the foot of the jig, locating it by measuring to any of its sides from lines drawn when the original layout was scribed, squareness of the hole and its correctness of location relative to another hole, line, edge or flange, as the case may be, are insured.

An oil hole is provided for use when the piece to be reamed is of wrought iron or machinery steel. Cast-iron jigs are best reamed dry.

For those who have had to drill and ream holes, either straight or taper, to line and without any guide, this tool will be a welcome aid. With its use it is only necessary to drill the holes fairly correct, locate the guide, and the reamer does the rest.

H. E. B.

Cutting Bevel Gear Teeth on the Band Saw.

Editor American Machinist:

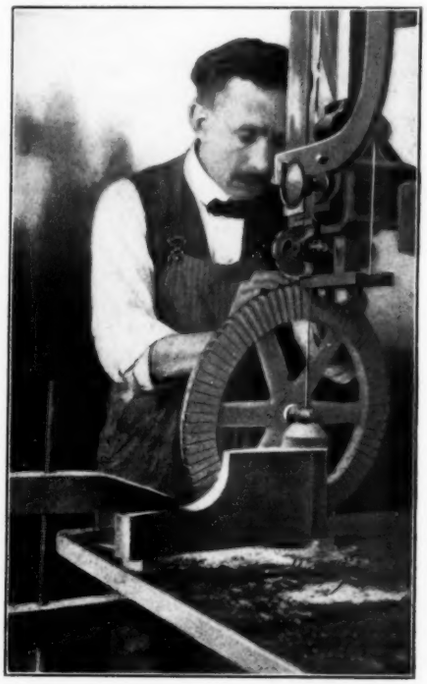
I send you a photo, which will explain itself, showing the bandsaw as a bevel gear cutter. The cutting edge of the saw runs through the center of the ball, and the center of the ball is at the intersection of the center lines of the gear and pinion shafts. The teeth are laid out upon the outer edge of the gear in the usual way and the operator has only to work to the lines. I have cut gears up to 36 inches in diameter in this way, so that only sandpapering was required to finish the teeth.

J. L. GARD.

Draftsmen's Scales.

Editor American Machinist:

The articles in recent numbers of the AMERICAN MACHINIST on draftsman's scales have brought out some points that every draftsman ought to consider. The scale is a tool which should be used as unconsciously as a pen or a pencil. The draftsman should not have his thoughts interrupted while laying down his design by having to be sure he has the proper edge of his scale. I cannot see how Mr. Griffin and his clamp can defend the triangular scale. I have given a number of different scales a good trial, and the triangular scale has shown up sadly wanting.



CUTTING BEVEL GEARS ON THE BANDSAW.

Neither do I agree with Mr. Lyne that the flat boxwood scale with beveled edges or that a draftsman's scale with graduations to the extreme end is the thing. The corners are too apt to suffer. The bevel edge flat scale does not permit of as accurate laying off of points as the triangular scale.

The first scale I ever used was a flat bevel edge scale graduated on two edges, which served my purpose very well for some time. It was light and very handy and I was never conscious of hunting for the right edge. However, one unlucky day I got hold of a triangular scale and was so pleased on first trial that I adopted it and discarded my old scale. I found the edge much better adapted to laying out accurately and the scale much easier to pick up than the old one, while I was not at first much confused by the number of different graduations, as I was not particularly busy, and went so far as to purchase a second triangular scale with the sides relieved from the edges, as the graduations soon wore off the first one. I presume all draftsmen understand what kind of scale I refer to. The angles are more acute than 60 degrees, allowing the edges only to rest on the table, thus protecting the graduations from wear. To cut a long story short, there came a busy time and I was more bothered with that triangular scale than I ever care to be again. Not only were the cross scales on the same edge productive of mistakes, but I was always in fear something would fall on

that delicate top edge and nick it. The engineer borrowed my scale one day for a few minutes and, just as I expected, he handed it back to me with the remark that it would be more profitable to the company if I would get a decent scale. He couldn't see how anyone could turn over a scale two or three times and then turn it end for end every time he used it and accomplish much else.

I am now using a set of scales each of which has a simple scale on each of its two working edges. I am surprised that the scale has not been mentioned, as it is a standard article of manufacture by Brown & Sharpe. The scale is of sheet steel bent to about 60 degrees opening with a beading at the apex of the angle. The graduations are on the two lower edges. This makes a light scale, having a proper angle to the drawing. It is easy to get hold of and has no confusing edges. I think it has all the good qualities of the flat bevel and the solid triangular scales, with all the bad qualities eliminated. H. H. KENNEDY.

[Our contributor seems to have misread Mr. Griffin's article at page 357. The scales which he illustrates were of the Brown & Sharpe pattern which he says "has the same advantages as the triangular scale in the angle at which the graduated edges lie to the paper." Mr. Kennedy and Mr. Griffin agree regarding the advantage of the *form* of the triangular scale, which the latter considers sufficient to make that scale, when used with a clip, better than the flat scale, while the former does not.—Ed.]

A Patternmaker's Wax Press and a Dowel Making Tool.

Editor American Machinist:

I enclose a sketch, Fig. 1, of a patternmaker's press for making wax fillets. The brass pipe *a* has an end *b* soldered in. The end has a hole drilled through it and a plate *c* has a series of holes of the different sizes required. A handle *d* enables any hole in the plate to be made to face the hole in the end of the pipe.

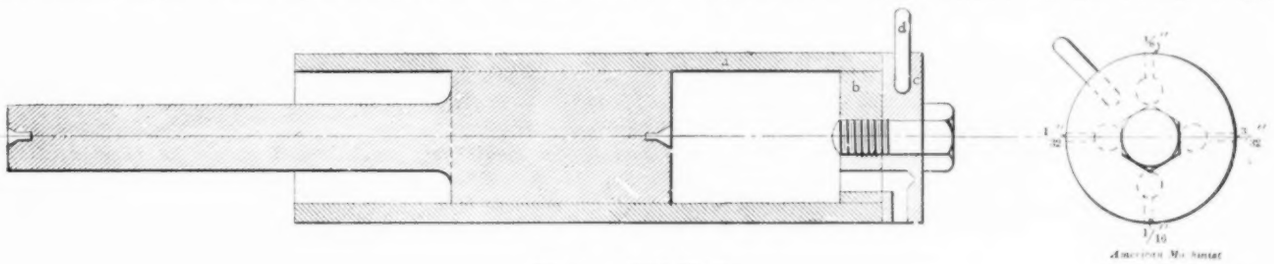


FIG. 1. A WAX PRESS.

Fig. 2 shows a dowel cutting tool which is operated by holding the tool in the hand, the piece of wood being chucked in the lathe, or the tool may be held in the vise and the dowel be turned through it with a bit brace. F. A. C.

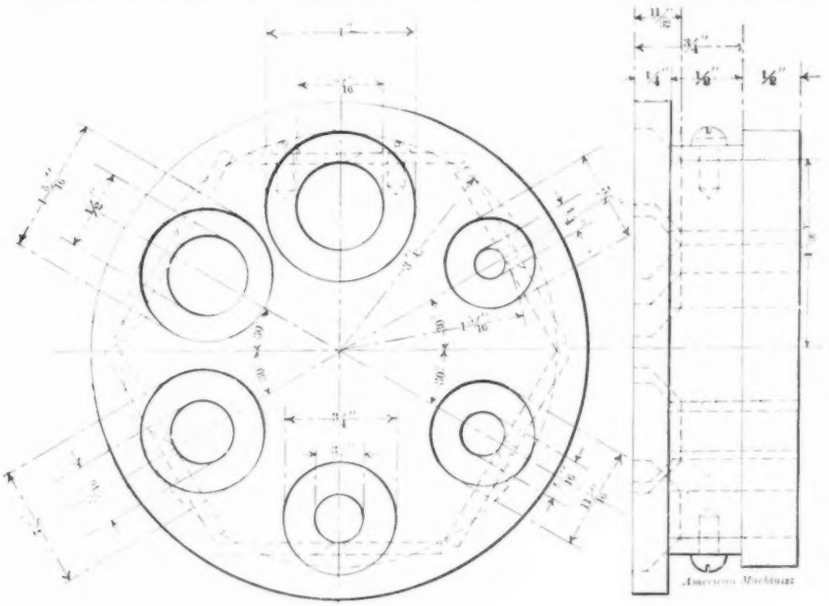


FIG. 2. A DOWEL MAKING TOOL.

Making Bronze Castings for Embossing Dies.

Editor American Machinist:

A reader of the AMERICAN MACHINIST for over twenty-five years and a brassfounder by occupation, I am interested in any article in my line. On reading the instructions given by Mr. C. Vickers, at page 353, it occurred to me that you might find a place for an account of some actual experience and of the methods used in producing a line of work somewhat similar to the die spoken of by that gentleman.

The work I refer to is the making of plates used for embossing the material known as "Lincrusta Walton." These were cast from the plaster model, and they ranged from 30 to 200 pounds in weight. The sand I used was what is known as No. 0 Albany. For facing I used one-third of "Brooklyn" sand, dried and pulverized and put through a No. 60 sieve, and two-thirds of the Albany tub sand. Mixing the two thoroughly together, I put the whole through a No. 24 sieve and wet it with water in which I had dissolved a handful of salt. For double-facing, or printing back, I used the Brooklyn sand thoroughly dried and shaken through a heavy Canton flannel bag. The parting material I used is known to the trade as prepared charcoal.

The patterns, being plaster casts, were a great deal thicker than the casting was to be, the thickness of the casting being determined by the depth of the embossing, which in some places was 1¼ inches. I got with a depth gage the depth of the deepest part of the figure and then added ¼ inch to the gage and made a mark all around the sides of the plaster cast. I then rammed up a plain side and embedded the plaster, face uppermost, to the mark I had made around the sides. This then gave me the pattern raised above the surface of the mold to a hight of ¼ inch more than the deepest part of the pattern. I then placed the nowel on and rammed it up by treading with my feet. I lifted the nowel off as I would the cope, sprayed it very lightly with plain water, dusted on the facing, then the charcoal and placed it back. I loosened up the sand to a depth of an inch or so, put some more sand on and rammed it again, then took the nowel off, and put it in front of the drying stove until the face was dried to a depth of about an inch, then I took it down, placed it on a couple of rests, face down, and smoked it with a torch made of waste and rosin. The cope was just a plain-side rammed on a smooth board and well vented.

The metal used was a good bronze, and poured, when by pushing the surface back with the skimmer, no spelter smoke could be seen rising from it. Those castings left the sand absolutely clean and were put

into the machine they were made for without any manipulation.

I have tried the molasses water, both for wetting the facing and for spraying, but never had the satisfaction of seeing the castings so clean as when molded in the way here described.

R. M. WHITAKER.

An Important Patent Decision.

D. Walter Brown, 45 Cedar street, New York, writes as follows:

The United States Supreme Court has recently rendered a decision of much importance to inventors, in holding that the present practice of the Patent Office is incorrect in requiring applicants to claim all machines and processes in separate applications, even though the process and the machine are mutually dependent, and that the rule under which division of applications is required in such cases is invalid.

The case arose upon an application of Steimetz, the electrician, in which he claimed in the same application the certain method there described of measuring alternating electric currents and actuating an alternating current motor meter and also the apparatus. The examiner required the inventor to divide the claims, which seem to have been admittedly novel, into two applications—one for the method, and the other for the apparatus. The inventor refused to divide, and tried to appeal to the Board of Examiners in Chief. But the primary examiner refused to forward the appeal. Finally, after various proceedings in the Patent Office and the courts of the District of Columbia, the case reached the Supreme Court of the United States, which has decided that where a process and a machine are dependent upon one another, and not entirely separate and independent inventions, the inventor has a right to have them included in one application, and that this is a substantial right of which he cannot be deprived by any rule of the Commissioner of Patents. Also that Rule 41, in so far as it requires claims for such processes and machines to be put into separate applications, is invalid.

The decision is a very welcome and much needed one, and will at least much diminish, if it does not put an end to, the vexatious requirement of division in a class of growing importance in the electrical and certain other arts, where the invention of a process is practically inseparable from the invention of apparatus to operate it, and where the process is so dependent on the apparatus that it can be properly and successfully operated only by apparatus embodying the novel features claimed in the apparatus claims.

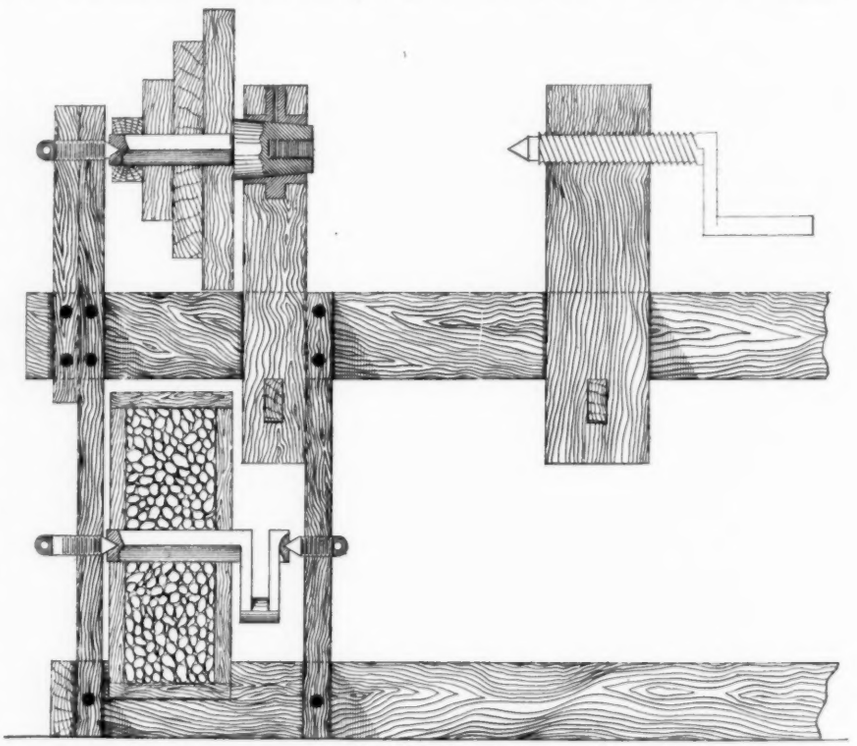
Heretofore, in all such cases, the inventor has been required to file two applications, with the risk of having one of them held invalid, or seriously limited by the courts, on reference to the other. Hereafter it will be possible to protect the entire invention in the one application.

A Backwoods Lathe.

BY JOHN RANDOL.

The first lathe I ever saw, to know about its use, was an original creation built by Benjamin Bloss, hunter, trapper and blacksmith, and Curtis Beals, hunter, trapper and handy man, in Wisconsin, more than half a century ago. Bloss and Beals were frontiersmen, always on the verge of civilization, and they decided, with no capital except a horse and wagon, to start in business as well drillers, and proposed to the Deacon, who had a little shop where he "wooded" steel plows made by a smith and one helper, and ground with a horse-power rig by a neighboring farmer, that the Deacon should give them shop room for the winter, while they two built their well-drilling rig.

I was at that happy age when everything



A BACKWOODS LATHE.

interested me, and what I did not know did not trouble me, and I had plenty of time to watch the building of the lathe shown partly in Fig. 1. The Deacon built the woodwork, which was almost all there was, of oak, to Bloss's order, and Bloss did the forging with Beals for helper. The flywheel was a round box full of cobblestones, mounted on a cranked square shaft carried on dead centers and run by a long treadle so that Bloss and Beals could both put their muscle on it. As soon as the wheel and treadle were mounted, the wheel was turned off, Bloss forging all the tools used on the lathe from old files. Then the lathe spindle, forged on a square iron body, was put up, with two blocks of wood driven on to the square, on dead centers over the flywheel, and a buckled leather strap, about 1½ inches wide, was put on one of the spindle blocks, and the other one was turned to make the first pulley, which drove the spindle, still on the dead centers, while Bloss turned the conical front-bearing of the spindle, with hand-tools held like wood-turning tools. Bloss did not use the heel-tool, but was an expert metal turner, and could cut good threads with inside and outside chasers which he called "cat's claws." The tail end of the spindle was carried on a dead center, screw-adjusted, and the spindle front-bearing was made of type metal, poured around the spindle when set in position in an auger hole bored in the headstock upright, the bearing being kept from turning by cross holes, all about as shown in the illustration. The tail-spindle was all one piece of square "Norway," then the best iron known, with a hand crank forged on, and the square twisted to screw into the wooden tailstock which was held to the bed by a wooden wedge underneath. The nose of the spindle was drilled and tapped.

On this lathe Bloss and Beals made that winter 400 feet of well-drill rods, screwed together, wooden rods with iron sockets. The threads were, I think, about 1½ inches diameter, the female threads chased and then tapped with a sizer, and the male threads chased to go in hard with two 3-foot wrenches, and the joints very nicely squared up and turned outside and interchanging perfectly. They also made several well drills, iron with steel bits, always old files for their tool steel, and they made an upright big wheel, with a frame high enough to let the horse, hitched to a sweep, walk under the wheel, which had ¾-inch round pins driven in its edge to work a rocker arm and lift and drop the well

drill. In the spring Bloss and Beals sold the Deacon their interest in the lathe for $5.00, and with this capital they started drilling wells, and came back with more than $200 in the fall, which was good business in those days.

Bloss and Beal's methods seem primitive, but they made money, as much as was expected, and the whole job was on even terms with what plenty of machine shops think is the only sensible thing to do to-day—stick to what is ready to hand as long as it makes a living all around, and don't quit good-enough things you know all about for things untried, which may or may not be better.

From one point of view the policy of most tool-builders and the policy of most tool-users is the same, and is that of Bloss and Beal—that is, to use the thing at hand, no matter what, and no matter how indifferently well or ill it serves the purpose.

Professor Sweet is venturesome in telling tool-builders that their open machine frames are weak and costly, in showing them how to make them cheap and strong and in advocating spiral gears, though Sellers has just finished a planer for the Bethlehem plant, 100 tons guaranteed pull, spiral gear and rack drive, notwithstanding the commonly accepted belief that spiral gears are bad. Indeed, it is quite surprising that the engineer who so aptly rebuked Professor Sweet at the society meeting by saying that worm-driven elevators did not receive orders for installation, did not also add, what some books say and many machinists believe, that spur gear teeth roll on each other without sliding when at work, while spiral gear teeth do slide on each other, and hence must wear rapidly. In point of fact, spiral gear driven elevators which give great satisfaction are largely manufactured at Harrison, N. J., just across the Hudson from where this statement of their prohibitive design fault was made.

Machine tools are built to be sold, and machine shops are operated to obtain customers' orders, and who shall say that machine tools which do sell, and machine shops which attract and retain a paying patronage, are not well and wisely directed?

It is true, probably, in the light of past history, that not only box frames and spiral gears must be some day, perhaps not so very far from now, standard features of machine tool design, and that the time will come when o r splendid machine tools of to-day will look as rude and illy considered as the Bloss and Beals production looks now; but this probability does not warrant the assertion that machine tool constructors should instantly abandon present practice in favor of the most advanced construction known or proposed. It is quite certain that the tool-builders will stick to the present forms so long as there is a market for them, and that most machine shop managers will be very slow to abandon tools which are in good condition so long as their customers repeat orders. But it must be remembered that the best machine tool of to-day is very much more effective than its prototype of twenty years ago, and that history constantly repeats itself.

Legal Notes.

BY E. P. BUFFET, LL.B.

ILLINOIS COMPANY STORE LAW VOID.

The Supreme Court of Illinois has lately declared unconstitutional a law against the "truck system." The first two sections of this act, prohibiting an employer engaged in mining or manufacturing from keeping or being interested in a store for furnishing supplies, tools, clothing, provisions or groceries to his employees, and rendering such conduct a criminal offense, had already been overthrown by the courts. The third and fourth sections forbade making deductions from wages except for lawful money, checks or drafts advanced or mutually agreed sums for hospital or relief funds, and provided for the recovery of such deductions without offset. Section 6 exempted from the operation of the law the dealings of farmers with their employees.

The case under consideration was an action for wages due brought by a miner before a justice of the peace against the Kellyville Coal Company, who attempted to set off against his claim a debt for groceries and supplies. The suit when it came on appeal from the Circuit to the Supreme court stood in favor of the plaintiff. The latter tribunal, in reversing it, holds that not only are sections 1 and 2 of the law invalid, but the whole act. This is partly on the ground that the discrimination as to farmers, which is a material one, deprives the miner and the manufacturer of the equal legal protection guaranteed by the Federal Constitution. "Furthermore," says Judge Cartwright, "it is not within the power of the Legislature to provide that one who is possessed of property may not sell it to another, and agree with the purchaser to work for him in payment for it. The privilege of contracting is both a liberty and a property right. The laborer has a right to contract with respect to his labor, and to make such terms and agreements as may be mutually agreeable to him and his employer. They may agree that the labor of one shall be paid for with the property of the other, or the laborer may agree to work in payment of a pre-existing debt, and in either case the rights of the parties are free from interference by the legislature."

It would appear that if sections 3 and 4 of the law had been sustained the employer might still have recovered the debt for supplies furnished, by a separate action, but this distinction is of no importance now that the restraints of the entire act are removed. 69 N. E. Rep., 927.

ABBREVIATIONS OF CORPORATE TITLE.

In a late case reviewed by the Supreme Court of Illinois objection was made to admitting in evidence a contract of the Peoria Manufacturing Company on the ground that it did not purport to be signed by that company, "Mfg." having been used instead of "Manufacturing." "This objection," says the court, "is too technical. The letters are an abbreviation of the word and they are no more subject to criticism than the use of the abbreviation 'Co.' for the word 'Company.'" 69 N. E. Rep., 802.

Direct-Metal and Cupola-Metal Iron Castings.*

BY THOMAS D. WEST.

A short time ago I had occasion to cast plates 1 inch in thickness, with direct metal containing Si, 0.51; S, 0.045; Mn, 0.75, and P, 0.094 per cent. Much to my astonishment, I found that there was no trouble in planing them, whereas if cupola metal of like composition had been used, the planing would have been a difficult operation. In view of the interest taken at the present time in the subject of using direct metal for foundry purposes, a few remarks on my observations, while handling this metal in daily routine, may not be amiss, and may create discussion.

I have often noticed a greater fluidity or life in furnace metal when compared with the cupola product. Iron can be seen flowing down the furnace runners from 50 to 100 feet before reaching the last pig in very satisfactory shape, while cupola metal might solidify before it had reached one-half the distance. I have seen Bessemer iron in a 30-ton ladle held for nearly an hour and a half during repairs to a crane; and after skimming off the coke dust, it had to be cooled considerably before being cast.

As a general proposition it is known that the comparatively lower sulphur-content and the higher temperature of direct metal over the same iron remelted in the cupola has much to do with its greater life, yet there are some problems connected with this phenomenon which would seem to call for further study. For instance, furnace metal containing more than 1 per cent. silicon holds carbon which is separated as "kish." This separation does not take place to any great degree while the metal is very hot, but during its gradual cooling, at times, the kish is given off in such large quantities as to cover the ground for an area of from 20 to 30 feet around the ladle.

Perhaps this throwing out of the excess carbon then makes the life of the metal shorter thereafter. It would be well to ascertain the carbon-content of a ladle of iron during the stages of the cooling process, and thus determine the effect of the carbon reduction more accurately.

In making "direct metal" castings the separation of kish becomes a nuisance, although it is more generally confined to the higher silicon metals. The higher carbon undoubtedly has much to do with keeping metal with the lower quantities of silicon

* Read at the Atlantic City meeting, Feb., 1904, of the American Institute of Mining Engineers.

softer, than if it were a cupola product of like composition, excepting the total carbon-content. Perhaps some of our furnace friends can throw light on this interesting matter.

High-Speed Steels.

At the recent meeting of the National Metal Trades Association in Philadelphia William Lodge, of Cincinnati, presented by request a paper on the subject named in the title above, from which paper we abstract as follows:

High-speed steels have been, are now, and will be in the future, responsible for a great onward and upward movement in the industry of machine making. The possibilities for machining metals—particularly so far as lathes are concerned—have been increased at least fourfold in the manipulation of wrought iron and steel and at least threefold in the manipulation of castings. In order to take advantage, however, of the possibilities in the steels, it has become necessary, in order to make all the conditions right, to re-design—not only the machines themselves but to rearrange the old methods of both holding the work and driving it; new methods must be adopted of mounting the tools and of holding them, as well as new methods of dressing and grinding, and while this may not apply so fully to small jobbing shops, it is perhaps the most burning question that manufacturing institutions have to deal with.

There has never before been a period in the history of the machine-making industry that compares with the present period in the matter of acceleration for the whole establishment brought about by the advent of high-speed steels. Manufacturing establishments that formerly got along reasonably well with the old methods of handling, storing, distributing and routing all work in process of construction, will find it necessary to make a complete change in order that they may make the various conditions connected with the industry keep pace with the rapid motion of the work through the factory. High-class mechanical engineers are necessary in order to lay out suitable stockrooms to receive in their proper proportion all goods that come under the class of merchandise and that are bought ready to go into the machines. Other means will become necessary for storing castings, both of large and small sizes, also means of taking care of bar stock in such manner that even boys or men of light build may readily handle bars weighing as much as a ton, from the rack into the machines and out again. The stockroom man must be in evidence, the receiving clerk, the routing official for routing the work through the establishment, the industrial railway delivering the goods from the yards under the cranes of the shops for rapid distribution to and from the various machines—better arrangements for distributing room for tools throughout the factories—in this respect an utter and entire change will be necessary and a large amount of the red tape formerly used must be dispensed with and simpler and easier methods employed. There must be standard gages and measuring instruments of all descriptions, and a system of manufacture, making it possible for each and every piece to be made entirely without reference to the piece to which it is assembled.

All our manufacturers will find it necessary to carry out a most vigorous campaign in their establishments, covering not only the conditions named, but also the still more important ones of equipping with up-to-date appliances and designs, especially with a view of using all the benefits conferred upon us by the advent of high-speed steels.

The following will give you some idea of the possibilities, or at least those of you who have not gone into the matter as fully as I am about to describe.

In testing some of the machines designed especially for high-speed work our company has expended thousands of dollars in order to determine just the kind of drive that must be applied where motor drives cannot be used, and we have met with many and great surprises in conducting these various experiments. Speaking of lathe work, the old-time thrust bearing with all the other frictions which had been incorporated into the former designs, are found to be a great barrier to the use of high speeds, and new designs have become necessary for thrust bearings, for lathe centers and for means of applying the power so as to deliver it to the cutting tool itself with the least loss in friction. In conducting these experiments (a 30 horsepower motor with an ammeter attached so that the power could readily be read) we have found in friction alone a consumption of more than half of the horsepower. I mean by this that if sufficient speed is applied to the old-style design of engine lathe to take advantage of the high-speed steels, the friction engendered through the running of the cone pulley on the spindle and the thrust bearings and centers, consumes an amount of power that makes the power plant inadequate. New and better designs were found to be necessary. We also found that in one case a difference in rake of tool made a difference of 100 feet per minute in possible speed of work.

Then comes the necessity of testing out the value of the different steels offered, and while these have varied in the past year to a very large extent, the tool-steel manufacturers are all of them working with the utmost care and intelligence, and our later experiments have shown a wonderful improvement in the uniformity and the staying qualities of steels of various makes.

It soon became apparent while following this subject, that newer and better methods of chucking the work and of holding it to meet the strenuous conditions are necessary. The old-time bent-tail dog must give way to something very much more substantial; the methods of obtaining diameters must all be dispensed with, and ready means for getting correct diameters, feeds, etc., by an unskilled workman must be adopted. To a great extent the old-time universal lathe, that was good for all jobs, must give way to the lathe made for its own particular work in manufacturing establishments. I do not mean by this that the regular ordinary type of lathe must be abandoned; it will always be a necessity, but possibly one-half of the lathes installed in the future will not be of that type, but will be designed more especially for a given class of work, with all the facilities for rapidly machining the work with the least possible consumption of both labor and power.

I have no doubt it will be a matter of great surprise to some of our members to hear that I have personally seen within two weeks a lathe running at 180 feet per minute, reducing bars of steel 3⅛ inches in diameter to 3 inches sufficiently true at one cut to be delivered to the grinding machine and without regrinding the tool once until seventeen pieces were machined each 4 feet long. A difference in the time of machining this piece as compared with the old plan of one hour down to 2½ minutes—and a better piece of work, and within two days the same machine was reducing pieces ½ inch diameter at 250 feet per minute with 1-30 feed and the tool holding up to the work.

This seems incredible and yet it is perfectly easy to prove to anyone sufficiently interested to take the trouble to investigate. I have seen a tool stand up a solid hour on cast iron at 125 feet per minute removing the scale. It must not be imagined, however, that such results as these are obtainable from machines of the regular design; not only must the machine be made to suit the new conditions, but the methods of holding the work, of driving, of holding the tools and of grinding, all of which carry along with them better methods of handling, must be adopted.

Under these new conditions the machine-tool builder is very often put at a great disadvantage. When the possible buyer becomes acquainted with some of the facts mentioned above, he immediately is willing to place an order providing results are guaranteed, but is generally not satisfied with these results. These results may be shown to him in the works of the builder, but, finding when he gets the machine in use that the results do not follow in his own shop, he is too much inclined to lay the whole burden on the shoulders of the builder, who, in any event, makes only one profit when he sells the machine, while the man buying the machine makes an enormous profit each day.

I have a case in mind at the present moment where a certain equipment was delivered over a thousand miles from the

shops of the manufacturer to the customer and who failed signally in making use of the machinery—refused to pay for it, and put it up to the manufacturer to send someone this thousand miles and virtually change the conditions in the shop, refusing to reimburse the manufacturer on the ground that the machines were sold to do this work and that it was the business of the maker of the machines to actually demonstrate their qualities to him in his own establishment. If this spirit is displayed very extensively, it is going to stop the progress that is obtainable, from the fact that the man who gets the advantage is not willing to shoulder any part of the burden.

It must be borne in mind when dealing with this subject that a little difference in the hardness of the material upon which these high-speed steels are engaged makes a great difference in the speed at which they may be run. Ordinary mild steel can be turned all day long at 180 feet per minute with a ¼-inch feed and ⅛ reduction; in fact, I have seen this done on steel of .20 carbon—or at least the steel was sold for .20 carbon, but we made no analysis of it to prove that this was exactly correct. Again we recently saw some cast-iron rolls which had formerly never had less than two cuts, and frequently three cuts, turned from the rough casting at 150 feet per minute with ⅛ feed, ½-inch reduction at one cut—nice enough to go to the grinding machine.

In the matter of deep drilling, lathe spindles of .50 carbon that formerly took 5 hours are now finished in 30 minutes; former speed of 40 revolutions per minute being changed when boring a 1 9-16 hole to 400 revolutions per minute and the feed from three thousandths per revolution to six thousandths per revolution.

We also find quite a little opposition in installing high-speed machines from the men who run them—referring to one shop only as an illustration. A man had spent the time from 7.00 in the morning until 8.30 without starting his machine, and when approached by the foreman to know why the machine was not running he said he had to "take some time to clean up." Upon the foreman inquiring if 15 minutes was not sufficient to wipe off the machine, the answer was, "I am tired and have to rest." This lost him his place. The second man lost his place because he consumed more time in putting the work in and out than he did in the actual doing of it. These are matters, however, that will be adjusted in the hands of efficient managers.

It must be remembered that much more space around each machine is required, both for the stock in the rough and for the finished stock. I have found this from our own experience and point it out, so that others may avoid the same difficulty and thus save a rearrangement of the machines with all that it involves.

What I have said is barely a synopsis of what may be said on the subject, but I trust it is sufficient to set all of you to thinking; and I want to assure you that there is no intention on my part to secure any personal advantage, but merely to direct the attention of the members of the Metal Trades Association, or at least those of them who are not aware of it, to what is going on; because it is better to be in advance than to have other nations force us, through their superior knowledge of this subject, to follow them.

The period is not far distant when we shall find the markets of the world a necessity, as the rapid growth of our industry in our own country has already brought our production to a point where it is likely to be greater than the consumption, and in order to compete for the markets of the world—especially in view of the labor conditions we have to contend with—it behooves all of us to be on the alert and to see to it that no stone is left unturned that will assist us to become the foremost industrial nation and to make our product so well known the world over that the mere statement that an article is made in America will be sufficient for the buyer to take it for granted that it is as represented in every particular and that the mere offering of it should mean its sale.

Bronze Ordnance.

It must be nearly half a century since bronze was superseded by iron as a material for the manufacture of ordnance in this country; and it must have come as a surprise to many people the other day to learn that the Austro-Hungarian Government were about to rearm their field and horse artillery with a bronze field gun. As a matter of fact, however, the Austrians have retained bronze as the material for their field guns up to the present day, and there is, therefore, no reversal of previous policy in their decision to employ bronze instead of steel in the construction of their new gun. While other nations have been steadily improving and developing their gun steel, the Austrians have as steadily developed their gun bronzes, and they now claim that their gun material is both cheaper and more efficient than that employed elsewhere. It is to officers of the Austrian artillery in particular that the great development of gun bronze is due. To English ears it sounds odd that the greatest names in this connection are those of two field-marshals—Lieut. Field-Marshal Uchatius and Lieut.-Field-Marshal Thiele. It is reported that these gun bronzes are of approximately the following composition:

	Per Cent.		Per Cent.
Cu	61.50	to	53.90
Zn	35.70	"	40.00
Mn	0.60	"	3.75
Al	0.94	"	1.25
Fe	1.26	"	2.00

It is believed, however, that in some instances the manganese percentage runs very much higher—probably up to 10 per cent.

Good bronzes of this description can be forged, rolled or solid-drawn, and the recent official pamphlet on the subject claims for the Austrian gun bronze, forged by a secret process, qualities equal to those of the best nickel steel. The inner tubes of the guns are probably solid-drawn, in much the same way as the Ehrhardt steel gun tubes, while the jacket is probably cast and then bored out to receive the inner tube.

The weak points about these copper alloys—at any rate, as known in this country—are their low elastic limit, their want of homogeneity, which leads to molecular strain under repeated stresses, and their greater susceptibility than steels to the high temperatures which must obtain in the gun chambers. We have much to learn, however, on the subject of the manufacture of these bronzes, and there are many little details—as to casting temperatures, for instance—with which we are as yet unacquainted.

It is claimed for bronze guns that they are cheap. The cost of the raw material, however, must be greater than that of gun steel; on the other hand, the cost of manufacture is probably less, and the metal is still of value when the gun itself is worn out.—*The Engineer* (London).

The Premium Plan in Great Britain.

The following announcement from *The Engineer*, of London, tells its own story:

The demand for the pamphlet on "The Premium System of Paying Wages" has been so great that two editions were rapidly exhausted, and we have found it necessary to print a third. This is now ready, and since we were obliged some time ago to tell many correspondents that copies could not be obtained, we take this opportunity of informing our readers of the appearance of this third edition. It is substantially the same as the two previous issues, and will, we believe, be found valuable to employers and managers who contemplate adopting this rapidly extending system of paying workmen.

The biggest searchlight in the world will be seen at the World's Fair. It was recently finished in an electric plant at Lowell, Mass. It weighs nearly four tons, is of 5,250,000 candle-power and projects a beam of light 7 feet in diameter.

Water is so nearly incompressible that "practical" men are apt to think of it as absolutely so; yet here comes along Professor Toit with the assertion that if the water in the ocean were not compressed as it is by its own weight the level of the sea would be 116 feet higher than it is at present. In that case two million square miles of what is at present dry land would be submerged, and then where would we be? So much we owe to one little thing.

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Pig Iron as Produce.

The proposition for the New York Produce Exchange to deal in pig iron storage warrants must strike the unsophisticated reader as somewhat anomalous, and yet why not pig iron as well as the other raw materials? The storage warrant system or the dealing in those certificates representative of actually existent material is no new thing. We certainly called attention to some features of the business fifteen years ago. The system as in practical operation in the United States to-day is thus described in the *Journal of Commerce* (New York):

"The storage company known as the American Pig Iron Storage Warrant Company has established storage yards in various iron-producing district under strict supervision of the company's agents. The producer of iron who is desirous of placing the product of his furnace in the custody of the storage company issues a certificate showing the weight and the grade, by fracture or by analysis, when the iron is delivered into the storage yard. The agent of the company also issues a sworn certificate, giving practically the same details regarding the same iron as is contained in the furnace certificate. The work of the yard agents of the storage company is subject to verification by an inspector. Upon the delivery of the storage and the furnace certificates to the warrant company, a warrant is issued, signed by the president and secretary of the company and countersigned by the fiscal or transfer agent of the company—a bank or trust company. Thus issued the warrant is practically the same as a guaranteed warehouse receipt and may be bought and sold as are stocks or bonds. The warrant may be used as collateral for a loan if desired; banks have loaned upon such security from 50 to 90 per cent. of the market value of the iron represented. The warrants may also be dealt in on commercial or stock exchanges, as in Europe. The holder of the warrant pays to the storage warrant company 2½ cents per ton per month for carrying the iron. The consumer, as well as the producer of iron who deals in warrants, does so to obtain protection against fluctuations in the market for the actual metal during the life of long contracts."

This arrangement as it stands, and so far as the producer and the consumer are concerned, has its evident advantages. It seems to be quite a different thing when it is proposed to make the pig-iron certificates easy of handling by those who are neither producers, nor consumers, nor legitimate middlemen. It is the fictitious transactions, the buying and selling of the hypothetical—not the hypothecated—which leads to business derangement, and no arrangement which merely makes it easier to buy only for the sake of selling and to sell merely for the sake of buying, with no function of promoting the distribution or use of the actual goods, can seem to be in the interest of genuine and legitimate commerce or manufacture. The recent performance with cotton has crippled most mills and stopped many throughout the civilized world, and the increasing of the possibilties of cornering pig iron or of producing artificial and unwarranted advances or depressions of prices cannot well be looked upon with favor by the plodding men of the shop. It is fortunate for pig-iron and its friends and dependents that its production is not dependent upon the sun and the rain or the ravaging things which fly or creep, not so touched with the element of uncertainty as is the other produce, and that therefore the opportunities for and the temptations to gigantic speculation in it are not so unlimited.

A Proposed Patent Injunction Law.

A bill has been introduced in the House of Representatives to amend the patent statutes by providing that "injunctions to restrain infringements *pendente lite* [pending litigation] shall not be denied for the sole reason that the patent is of recent date or has not been adjudicated."

It does not require a patent expert to perceive that this is a matter which may prove of great importance. It means that in a patent infringement suit the aggrieved party shall not, for the simple reason that his patent is of unproved validity, be compelled to witness his opponent making hay while the sun of litigation shines and causing that particular sun to stand still in the heavens for many months or years.

Undoubtedly this is a question involving the results of intimate experience with patent law, the contentions against it, as well as those in its favor, being based on actual cases that have arisen, but a few general impressions of it may properly be formed, and these impressions are not entirely one-sided.

A formal argument in opposition to the bill has been made before the Judiciary Committee of the House, by J. Nota McGill, a patent attorney of Washington and New York. He calls attention to the fact that the measure assumes that preliminary injunctions are never at present granted on a recently issued or unadjudicated patent, this supposition being far from true. But even were such the invariable rule, he thinks it justifiable. Among the patents passed upon by the Circuit Court of Appeals from 1893 to 1902, only 45 4-9 per cent. were favorably construed. Since the introduction of Equity jurisprudence into our patent system, in 1819, the rules have worked to the benefit of patentees or they would have been remedied long before this. The danger from an injunction is often far more serious than the loss incurred by its refusal. The injunction in patent cases is a summary and dangerous method; it may cause the closing down of an important business. In regard to new patents, the defendant lacks the requisite information to protect himself without losing time. The great fault lies in the time consumed in taking evidence in patent

cases. The rule that this shall not in ordinary instances occupy more than three months is a dead letter. The root of the evil is with the lawyers, who waste their clients' time and money. And, besides, a speedy way to test the validity of the patent is open before a jury on the law side of the court. Such are a few of Mr. McGill's principal points.

These views may, in part at least, be strongly commended. By all means let us reform the lawyers as much as possible, but there is ground for fear that it will prove to be very much like reforming the Sultan of Turkey, and during the endless process his Macedonian clients will never be aware that it is going on. In fact, it looks as if this substitute for the proposed remedy might be left out of the question. Nor does experience go to show that long toleration of a custom proves a change to be undesirable; if such were the case there would be few evils in this world to remove.

Whether an injunction—characteristic of that often most inequitable form of jurisprudence known as "Equity"—is a method of procedure that deserves encouragement, is open to sharp dispute. Many acutely thinking men see with great apprehension the extension of the injunction to new and unusual sorts of cases involving the personal liberties of individuals, which should not be infringed without jury trial. But equity jurisprudence is nevertheless of great value in its proper sphere of application, which includes many questions involving the rights of property where the Common Law forms of action afford inadequate relief. Patent disputes are among those in which "equitable" processes may with great propriety be employed. The fact that they are thus availed of indicates that the alternative Common Law action referred to by Mr. McGill is not found sufficient. If it were, why should not injunctions be dispensed with in the case of old and firmly established patents as well as new and untried ones?

One of the chief defects in the working of the patent laws seems to be the readiness with which wealthy and unscrupulous corporations can appropriate the ideas of a poor inventor and secure impunity through their ability to wear him out in the courts. It is natural that these patents should fall in the class that are new and unadjudicated. There is need of better protection for men who resort to the courts to obtain simple justice and not to engage in a quibbling game of artifice and money. It is hardly necessary to point out how much less liable is the weak patentee to be forced into suits of this character, and to be kept involved, if his opponent is meanwhile debarred from fraudulently reaping the fruits of his invention.

There exists, of course, a danger that great and legitimate manufacturing enterprises will be tied up through frivolous pretensions of irresponsible persons, but the proposed law leaves the issuance of injunctions discretionary with the courts, and common observation does not show the average Federal judge to be wantonly reckless of the rights of "vested interests." Mr. McGill holds that the fact of the proposed amendment not being mandatory renders it the "more objectionable"—meaning, no doubt, the more insidious—but it seems, rather, that this discretionary feature will form ample safeguard for the interests of capital.

These are a few criticisms offered, not with any pretension of finality, nor in denial of the existence of concrete facts by which, perchance, they may be greatly modified.

The Metric Bill Not Passed by the House of Lords.

It turns out not to be true that the House of Lords has passed the bill making the metric system compulsory in Great Britain though it was so reported from what appeared to be a reliable source. The House of Lords has referred the bill to a Select Committee, which up to the present time has made no report. The fact that its reference to this committee was opposed by Lord Kelvin, who is an ardent advocate of the metric system, makes it appear that sentiment in the House is by no means unanimously favorable to the innovation.

Why do we see so many references in American technical literature to *London Engineering*? There is no such journal. There is *Engineering*, and it is published in London. If one wishes to refer to it and to mention its place of publication the form would seem to be *Engineering*, of London.

Representative Byrd has introduced in Congress a bill under which all kinds of agricultural machines and implements, including sugar machinery, etc., are to be admitted free of duty, and also iron and steel rods for use in the manufacture of such machinery and tools are to be made free under a drawback arrangement. We do not suppose, however, that he or anyone else expects such a bill to pass the present Congress. It is probably intended only to enable those who support it to place themselves on record as favoring the interests of farmers and as opposed to the Harvester and other so-called trusts.

If there is properly any measure of discredit attached to being a mercenary soldier; if we properly heap contempt upon the memory of the Hessians who fought here for England during the Revolutionary War, and if naval engineers may properly claim the honors and rewards of combatants, then how and where is the moral justification found for Scotch and other marine engineers who, without personal interest in the outcome of a war or patriotic impulse to take part in it, hire themselves to manage the engines of war vessels while actively engaged? Is such employment better from the ethical standpoint than would be the management of guns for money only?

A question that has often been propounded to us is as to the proper method of setting a threading tool for threading taper work, such, for instance, as pipe taps made to the Briggs standard. The question is, should the thread tool be set square with the surface of the tap, or should it be set square with the center line of the tap? We have always maintained that the proper thing is to set the tool square with the center line whether work is straight or taper, and upon consulting the Pratt & Whitney Company we have a letter from Mr. Eccles, the manager of their small tool department, in which he takes this view, saying that while this plan gives a short and a long side to the threads, it also gives a uniform angular condition—that is to say, any strain which may be brought upon the threads is resisted by surfaces which are always at the same angle with the axis, and for that reason he considers it better. At any rate, this is evidently the practice followed in making gages, taps and other tools to the Briggs standard, and should be generally adhered to for the sake of uniformity if for no other reason.

A friend sends a clipping from a New York paper in which is published an account of a motor boat exhibit and describing a motor which is said to present an innovation, inasmuch as the motor is "all in one piece." This, it is declared, "is the first time that this has been successfully tried for practical purposes, and that its advantages are that the vibration is not so likely to cause leaks or to force parts of the mechanism apart, as is sometimes the case with ordinary motors." We should say that this advantage certainly would result from the construction of a motor in one piece, and if we could get a photograph of a motor made in this way we should expect that it would be exceedingly interesting. We are left in the dark, however, as to whether this single piece is a stationary or a movable one, and it would be quite interesting to know about that.

The man who is worthy of being a leader of men will never complain of the stupidity of his helpers, of the ingratitude of mankind, nor of the inappreciation of the public. These things are all a part of the great game of life, and to meet them and not go down before them in discouragement and defeat is the final proof of power. —*Fra Elbertus.*

And this from the man who wrote "The Message to Garcia!"

The Siphon.

There is something peculiar about the siphon. It is a simple device which nearly everybody knows practically all about, and yet it is curious to observe how seldom its use suggests itself to those who are in a position to employ it to good advantage. An instance of this was noticed by the superintendent of a well-known tool manufacturing concern in New England. The roof of the shop had settled in a certain place in such a way that melting snow formed a large pool of water which was to a depth of five or six inches and covered a considerable area. It began coming in at a skylight and a man was sent up to remove this water, which he undertook to do by means of the old-fashioned baling process, when the bookkeeper, who of all others about the establishment might be supposed to have the fewest ideas about mechanical matters, suggested the use of a siphon. No sooner said than done. Mr. Superintendent gets a length of hose, takes it up to the roof, fills it, leaves one end in the pool and lets the other dangle over the edge of the roof, whereupon the siphon thus formed immediately goes to work and removes practically the last drop of water from the roof without labor and with a good deal more comfort for all concerned. The fact is that wherever water or other liquid is to be removed and can be delivered at a lower level a piece of hose or other form of siphon will usually do the work. Yet the idea of employing it seems seldom to occur to those who ought to know all about it.

Some New Things.

FOUR-SPINDLE RAILWAY MOTOR BORING MACHINE.

Through an oversight we neglected to say in the description of this machine at page 397 that it was made by the Newton Machine Tool Works, of Philadelphia.

THE HARTFORD ADJUSTABLE EXHAUST FAN.

This fan is shown in the half-tone, Fig. 1, and the cut Fig. 2 suggests the variety of its applications. The fan is first of all reversible right and left. At whichever side the pulley is placed the other side presents an unobstructed opening for the inlet. The fan may be placed upon a floor or platform or may be suspended from the ceiling, and whichever way it is placed the discharge may then be horizontal at top or bottom on either side, vertical up or down on either side, or obliquely between any of these positions. Single and double machines are built, adapting to the widest variety of service. The housing is of steel plate of such thickness as to withstand the abrading action of the material. The heavy iron pulley standard attached to the housing carries the Hartford continuous oiling boxes. The fan is made by the Hartford Blower Company, Inc., Hartford, Conn.

PROFILER WITH POWER FEED.

We illustrate a profiler adapted for finishing to gage at one setting with a roughing and finishing cut, light castings or long steel parts, such as typewriter frames, etc.—a two-spindle profiler with power feed. The spindle slides are balanced and the spindles run in adjustable bronze boxes, are provided with micrometer adjustment for depth, and fitted with gage stops for vertical and side adjustment, so that when

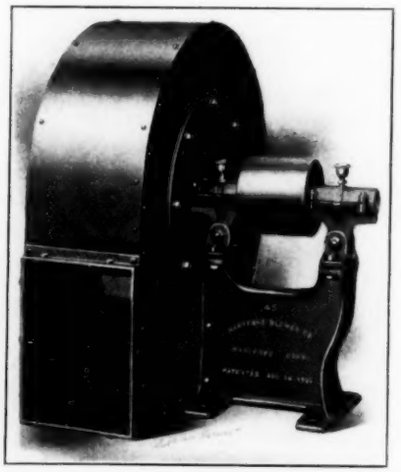
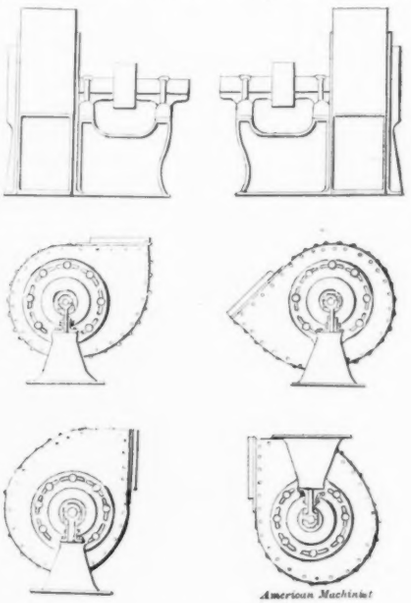
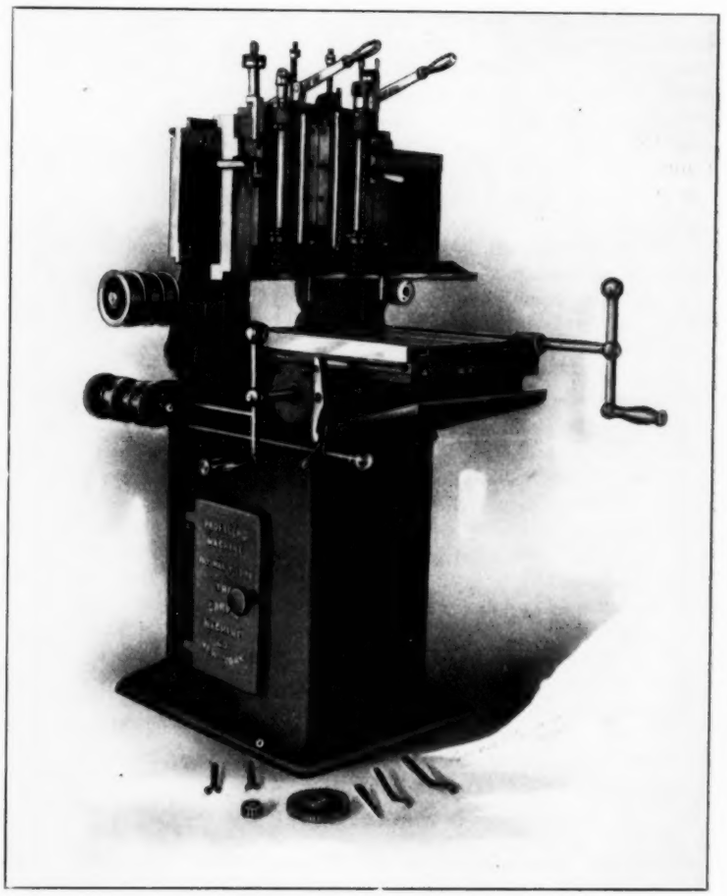


FIG. 1. HARTFORD ADJUSTABLE EXHAUST FAN.



FI. 2. DIFFERENT POSITIONS OF FAN.

the machine is set the piece can be roughed out with one spindle and then the other spindle is brought over and the piece finished to gage without resetting, adjusting cutters or any measuring whatever. The power feed gives the necessary uniformity for long cuts. The spindles are driven by the Wesson Patent system of universal joint-shaft drive from a special countershaft, which system gives every freedom of movement to the spindle without use of belts or jar of gears. The power feed is driven from the countershaft with four gear changes, and changes of speed are



PROFILER WITH POWER FEED.

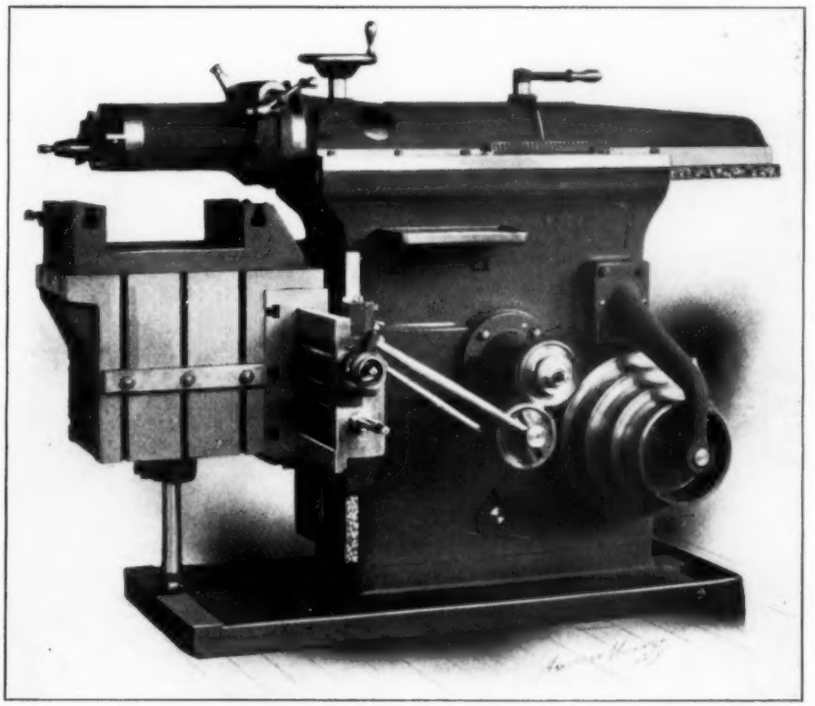
provided by a three-speed friction cone pulley on the countershaft. Automatic trip and reverse are provided. The table provides a long surface for holding fixtures. Capacity of machine: table feeds, 25 inches; clears hight, 5 inches; clears width, 16 inches. The maker is the Garvin Machine Company, of New York.

TEN-SPINDLE DRILL.

The multiple-spindle drill illustrated in the half-tone is designed for heavy work and will drill simultaneously ten 1¼-inch holes in steel. The spindles are worm driven, have four changes of speed and three rates of feed. They are equipped with quick advance and return mechanism, automatic trip, and automatic reverse for tapping, and may be operated singly or together as desired. The main working parts about the machine are provided with ball thrust bearings; and the bearings throughout are bronze bushed. The spindles are 1 15-16 inches diameter, are bored to No. 4 Morse taper, and have a traverse of 14 inches. The maximum distance from spindle to base plate is 48 inches; the minimum 34 inches. The minimum distance between spindle centers is 8 inches The distance between housings is 14 feet. The tight and loose driving pulleys are 24 inches diameter by 5¾ inches face and run at 425 turns per minute. The machine can be provided with a work table of any form required. The weight of the tool is 25,000 pounds. It is built by the Fosdick Machine Tool Company, Cincinnati, Ohio.

SHAPER FITTED FOR DRIVING AXLE BOXES.

The illustration is of a 24-inch back-geared crank shaper made by the Cincinnati Shaper Company and provided with a special head for planing locomotive driving axle boxes—*i. e.*, planing the seats for the brass which is pressed in. For this purpose a special vise is provided for holding the box and the head is made to rotate either by hand or automatically to plane the semi-circular seat. In the engraving the crank handle for hand rotation is seen and on the left side of the head is the lever and ratchet by means of which the automatic rotary feed is obtained. The shaper was designed for boxes 14 inches in length, and it will plane to a circle as small as 7 inches diameter, though the boxes it was designed for were for axles of 9 inches diameter. The strap at the side of the knee locates the box while being planed at the sides to fit the frame.

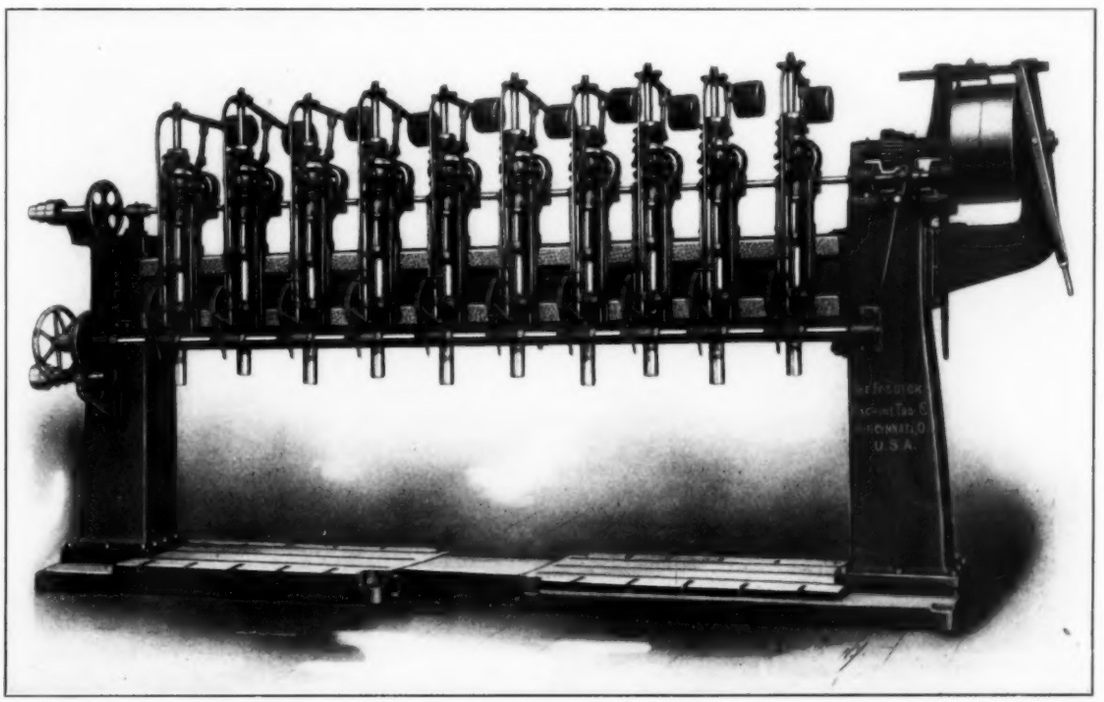


CINCINNATI SHAPER FITTED FOR PLANING DRIVING AXLE BOXES.

A PISTON-RING GRINDER.

The Heald Machine Company, of Worcester, Mass., have designed and are building an interesting grinder of which we present illustrations.

This grinder was originally designed



TEN-SPINDLE DRILLER.

with special reference to grinding piston rings for automobiles, gasoline and steam engines and similar work, but it is found that its field is considerably more extensive that it was at first thought it would be, and that it is also adapted for a large amount of surface grinding on collars, disks, dies, cutters, thrust collars for lathes, etc.

The machine consists of a magnetic chuck 8 inches in diameter mounted on a vertical spindle with micrometer adjustment. The grinding wheel is mounted in a cross-slide which can be fed across the work by means of the hand-wheel shown or an automatic power cross-feed can be supplied. The chuck carrying the work is driven by a cone pulley with eight different speeds. An adjustment is provided in the upper part of the column so that the machine can be made to grind hollow or crowning at the center. This latter feature is of value especially in grinding metal slitting saws which need to be thinner at the center for clearance. Fig. 2 shows the adjustable taper bearings in which the main spindle turns and the wheel controlling the vertical feed is graduated to read to thousandths and finer if desired. The machine is provided with dust caps for the bearings. Experience has shown that the power of the engine can be increased considerably by having rings ground to fit the grooves more perfectly than they can otherwise fit.

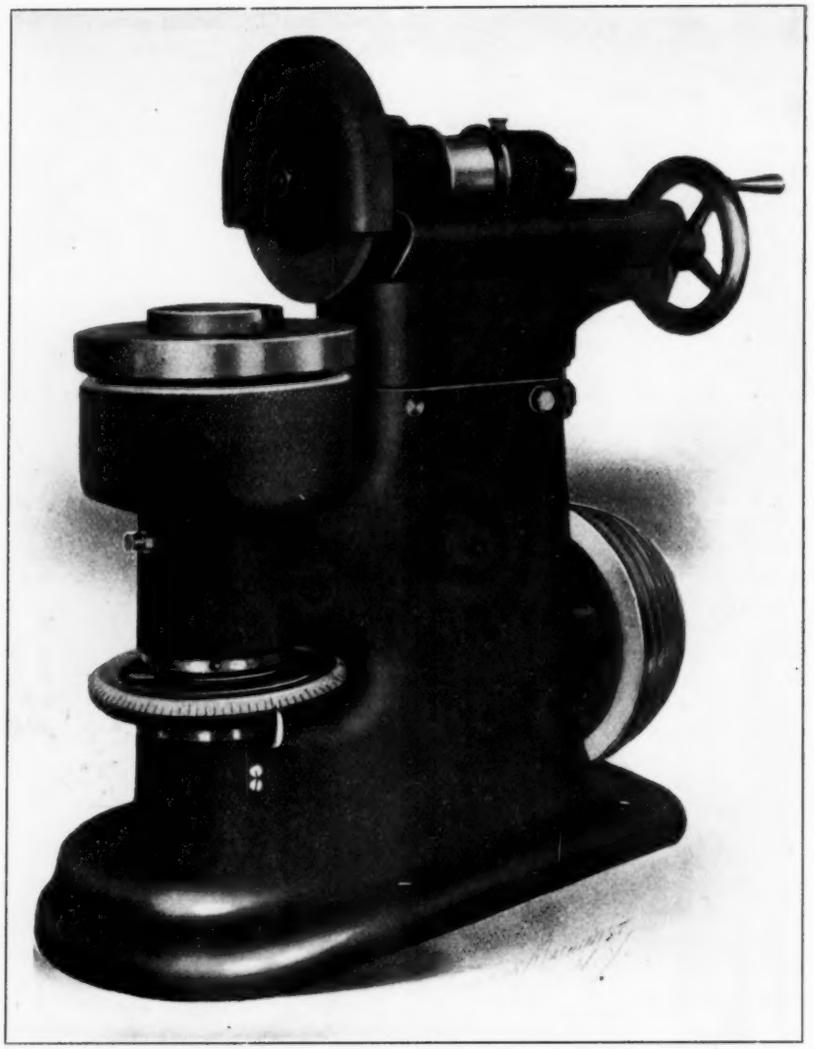


FIG. 1. PISTON RING GRINDER.

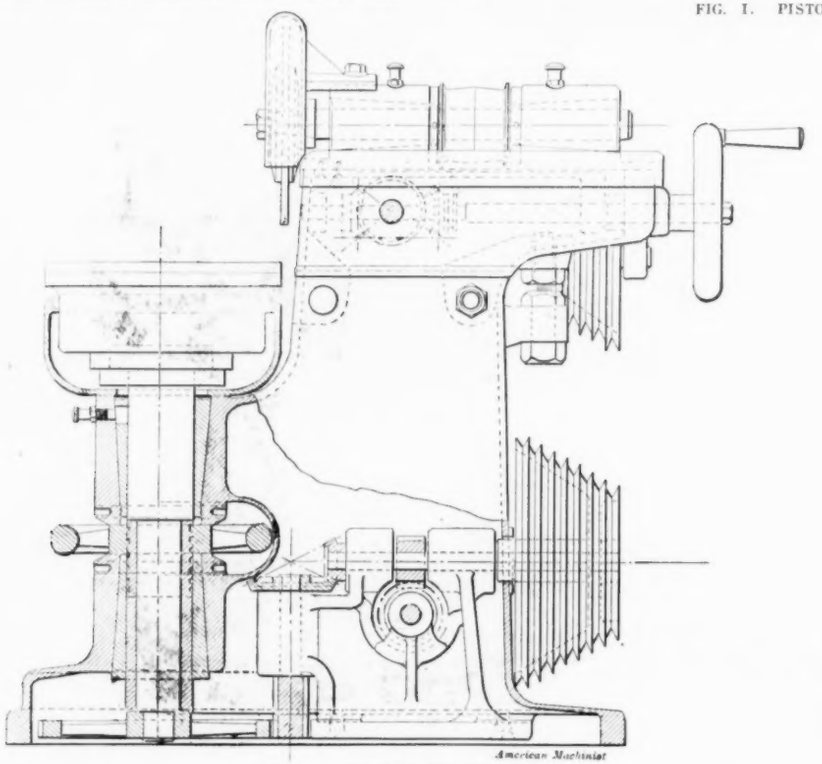


FIG. 2. PISTON RING GRINDER.

It was long an axiom at the River Plate that the English threshing machine could hold its own against all rivals. This is no longer the case. American threshers are daily becoming more in use, and for the simple reason that they are able to do much more work in a given time. An English threshing machine will turn out 1,500 to 2,500 bushels of wheat per day and require the services of eighteen to twenty-one men; whereas, according to an article in the *South American Journal*, the American machine will deliver 4,000 to 6,000 bushels and only require the aid of eight to ten men. In a country where harvest hands are scarce and highly paid—as much as 6s. per day with food—this is important. The grain turned out by the English thresher is usually better cleaned, but it is naively remarked that as the owner of the thresher is paid by bulk of grain, so much a "fanega," hectolitre, or bushel, he does not want too much cleaning of grain.—*The Engineer* (London).

In the interests of the manufacturers of electric motors it is to be hoped that the application of these highly useful machines to the driving of machine tools will not be abused or carried to extremes that will prove boomerangs, as has occurred in other lines of electrical work. Nothing reacts more disastrously upon the advocate of any engineering practice than the

discovery by "parties of the second part" that the practice is not justified or that the methods involved have been applied injudiciously. We hasten to interpolate the statement that we strongly advocate the use of electric motors wherever sound engineering principles require or allow it. It is not often, however, that individual motor drive is economical in very small units; it is also frequently inadvisable to obtain variable speed by means of complex systems of supply. Both of these two methods have their fields, of course, and they are by no means small ones; but neither method can be indiscriminately applied without ultimately bringing motor drive into disrepute as to fulfilling all the promises made for it.—*American Electrician.*

Technical Publications.

One of the latest additions to the list of technical journals is called the *American Cotton Manufacturer*. It is published at Charlotte, N. C., and the intention of its publishers evidently is that it shall be a creditable exponent of cotton manufacture in America, and particularly that which is carried on in the Southern States.

"Engineer's Arithmetic." By Fred H. Colvin and Walter Lee Cheney. 122 4x6-inch pages. The Derry-Collard Company, New York. Price, 50 cents.

This is a compendium of those portions of arithmetic in which many mechanics find themselves deficient. It cuts out everything not of strictly everyday use, and should prove useful to many. Among the subjects treated are decimals, square and cube root, the use of formulas, mensuration of surfaces and solids, horsepower and indicator diagrams. Tables are given of the average pressure of steam at various points of cut-off, of the areas of circles and of the properties of steam.

"Easy Lessons or the Stepping Stone to Architecture." By Thos. Mitchell. 92 5x7-inch pages with 80 illustrations. The Industrial Publication Company, New York. Price, 50 cents.

This book is a catechism in question-and-answer style and gives in brief compass a large amount of elementary information regarding the orders and styles of architecture, ancient, mediæval and modern. The origin of these styles, together with the principles which underlie their construction, is given in simple language. The explanations and illustrations of architectural terms are quite complete, and the book should serve a useful purpose to many.

"Machines and Tools Employed in the Working of Sheet Metals." By R. B. Hodgson. 311 pages 7x5 inches, with 282 cuts. The Technical Publishing Company, Manchester, England; D. Van Nostrand Company, New York. Price, 4s. 6d. net; $2.00.

This book goes over the entire field of sheet-metal work, describing the operations of shearing, punching, drawing, bending and spinning, the tools for each class of work, not only the various presses and other machines, but the dies which are used in them, showing the best practice and the most approved styles of tools for the specified operations. It also goes into the various details involved in the making of the dies and even shows lathes and other machine tools for such work. The sheet-metal work is not carried to such elaborate and difficult formations as have been shown in our columns, but a good variety of work is shown—in fact, as much as could be expected to be compressed within the space employed, and none of it is wasted.

"Cours d'Electricité; Cours de la Faculté des Sciences de Paris." By H. Pellat, Professor adjoint à la Faculté des Sciences de Paris. Vol. II. Pp. 554, 6½x 10. Ill.: 221. Paris: Librairie Gauthier-Villars, Quai des Grands-Augustins, 55. Price, 18 francs for the volume separately, postpaid in the Postal Union.

This is the second volume of a series of three, the first of which was noticed in these columns in a former year. The first volume covered electro-statics, Ohm's law and thermo-electricity; the present treats of electrodynamics, magnetism, induction and electromagnetic measurements, while the one in preparation will have to do with electrolysis, electro-capillarity, etc. Obviously this work is intended especially for the student and for others who wish to acquaint themselves with the theoretical side of electricity. The author explains that his object has been to establish solidly the fundamental laws of the science and to derive from them their principal results. He has not tried to omit the most important applications, especially those which rest on recent discoveries, but has not entered largely into their details, leaving them, rather, to special treatises. To adapt his work to as many people as possible he has sought the simplest demonstrations, rarely involving further than the elementary principles of the calculus.

"Practical Laws and Data on the Condensation of Steam in Covered and Bare Pipe." By Charles P. Paulding. 102 6x9-inch pages, fully illustrated. The D. Van Nostrand Company, New York. Price, $2.

In recent years a number of careful tests of steam pipe coverings have been made, but no attempt has been made to analyze them or to deduce formulas of general application from them. It so happens that this analysis was made in advance of these later experiments by the great French physicist Péclet, and, according to the present author, it is necessary to do little more than deduce constants from modern experiments and substitute them in Péclet's formulas in order to have a set of working formulas applicable to all ordinary conditions and to all of the insulating materials on which suitable experiments have been made. This is essentially what the author has done in the volume before us, of which two chapters on the Loss of Heat from Covered Steam Pipes and on the Loss of Heat from Bare Steam Pipes constitute such an examination of recent experiments and deduction of constants for various materials and for substitution in Péclet's formulas. The remainder of the book is a translation of Péclet's work—a translation which has not before been made, a fact which is no doubt responsible for the fact that the application of this work to present-day needs has escaped observation.

Personal.

William L. Saunders, vice-president of the Ingersoll-Sergeant Drill Company, has been elected president of the company to succeed the late William R. Grace. George R. Elder, manager of the manufacturing department at Easton, Pa., has been elected third vice-president.

Obituary.

In the death of William R. Grace, ex-mayor of New York, the Ingersoll-Sergeant Drill Company lost its president. Mr. Grace's acquisition of the controlling interest in the company, which occurred a dozen years ago, was only an incident in a phenomenally prosperous business career. Born in Ireland and running away from home as a boy, he began at once a commercial career of continued successes. With his brothers he built up a shipping and trading house whose interests and connections are world wide. His one manufacturing venture has prospered no less than his other lines of business.

Charles John Galloway, for over half a century prominent in the engineering trades of Lancashire, England, and early attaining an international reputation as an engineer, has just died in England, seventy-one years old. Mr. Galloway may be said to have been born into the profession. Upon leaving school he was apprenticed to his father and uncle, W. and J. Galloway, and in 1856 became a partner in the firm. He was connected with many public engineering works, and notably he constructed a viaduct over sands where such a work had been pronounced impossible. He also rendered valuable services in connection with some of the great exhibitions, especially the Paris exhibitions of 1878 and 1889.

Business Items.

The American Blower Company, of Detroit, Mich., is installing its "A B C" fan system of heating in the new shops of the Olds Gasoline Engine Works at Lansing, Mich.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio, has just received an order from the Denver Gas & Electric Company, Denver, Colo., for one 1,500-kilowatt, 2,400-volt, three-phase, 100-revolution-per-minute, 60-cycle, flywheel-type generator. This machine is a duplicate of one installed for this company about a year ago. The Denver Gas & Electric Company has also installed

four 600-kilowatt, three-phase, 2,400-volt alternators, which makes a total of 6,000 kilowatts in Bullock alternators installed.

The Nernst Lamp Company has recently established district offices at St. Louis, Mo., and Denver, Colo. The St. Louis office, embracing the Southwest territory, is located at 908 Pine street, with H. M. Reed as district sales manager. The Denver office, covering the middle Western territory, is located at 1619 Glenarm street, with R. D. Marthens at district sales manager. These offices will carry a complete stock of Nernst lamps and supplies, and will be provided with an attractive exhibition room, in which will be shown the different types of lamps in actual operation and in comparative tests with other illuminants.

Manufacturers.

The Henderson (Ky.) Woolen Mills have been burned.

The Athens (Tenn.) Hosiery Mills may install paper box machinery.

The pottery plant of F. H. Weeks in Eastern Akron, O., has been burned.

The Corbitt Buggy Company, Henderson, N. C., will build an extensive plant.

The plant of the Southern Ice Company, Rocky Mount, N. C., has been burned.

A pump factory building of Messrs. Allen & Burnett is being built at Sabina, O.

The Lee Paper Company, of Kalamazoo, Mich., will build a paper mill at Vicksburg, Mich.

The main foundry building of the Tacony Iron Company, Philadelphia, Pa., has been burned.

The Paton Manufacturing Company, jewelry, combs, etc., Leominster, Mass., will build additions.

Nail works are proposed for York, Pa., Benjamin Busler, of Sunbury being one of the promoters.

The G. W. Larkins Stave Company has been formed at Dickson, Tenn., for extensive operations.

B. L. Clarke is forming a company to go into the manufacture of coffins and caskets at Columbus, Ga.

Fire has destroyed the warehouse, furniture factory and sawmill of Baird Bros., Plattsville, Ont.

The plant of the Bayway Refining Company, oils, greases, etc., near Elizabeth, N. J., has been burned.

The car department of the Santa Fe Railroad shops at Albuquerque, N. M., has been destroyed by fire.

The plant of the Duncan Company, paper manufacturer, Mechanicville, N. Y., may be enlarged this spring.

F. J. Obert, of Reading, Pa., intends to erect buildings and engage in the manufacture of boilers at Lebanon.

The Union Naval Stores Company is about to build a big plant at Gulfport, Miss. It will have a turpentine distillery.

The Stevens Organ Company, Marietta, O., has let the contract for a new factory building, 50x100 feet, four floors.

The plant of the Champlain Silk Mill Company, at Whitehall, N. Y., may be enlarged, but the matter is uncertain.

The contract has been let for a two-story, 50x90-foot finishing building for the Cleveland (O.) Foundry Company.

A canning factory at Vincennes, Ind., is proposed to be built by the United States Canning Company, of Chicago.

The gas engine works of John Thompson & Sons' Manufacturing Company in South Beloit, Wis., have been burned.

It is stated at Edwardsville, Ill., that the Osgood Scale Company proposes to make extensive additions to its factory.

The Emerson Steam Pump Company, Washington, D. C., has ordered machinery for improving its plant at Alexandria, Va.

A two-story factory building, 30x104 feet, is to be erected and occupied by the Baltimore (Md.) Sash & Door Company.

A terra cotta manufacturing plant will be established at Lewis Run, Pa., by William Goeltz and others, of Corning, N. Y.

The plant of the Bates & Edmonds Motor Company, manufacturer of gas and gasoline engineers, Lansing, Mich., has been damaged by fire.

A textile mill at Frankford, Philadelphia, Pa., occupied by the Mercury Mills, of Adam Fink, and by other firms, has been damaged by fire.

Bartlett, Hayward & Co., iron founders, have permission to erect a brick addition, 26x45 feet, to their plant on McHenry street, Baltimore, Md.

The Stromberg-Carlson Telephone Manufacturing Company's works at Rochester, N. Y., are to have a 60x200-foot addition to the cable plant.

The United States Specialty Company's plant, Marion, Ind., will be enlarged to at least twice its present size for the manufacture of furniture.

The contract has been let for a 40x45-foot addition to the plant of the Bridgeport (Conn.) Deoxidized Bronze & Metal Company, for foundry purposes.

The excelsior mill, at General Scott street and Leake avenue, in Carrollton, New Orleans, La., owned and operated by W. B. Goll and George Fehl, has been burned.

A plant of the Erie Preserving Company, which has an office at Buffalo, N. Y., is to be doubled in capacity this spring, so that the year's output will be 4,000,000 cans.

Work is progressing on the plant that is being built in Bayonne, N. J., by the Electro-Dynamic Company, of Philadelphia, Pa., manufacturer of motors, dynamos, etc.

Work is starting on a four-story white lead building, 300 feet long, of the United Lead Company, of New York city and elsewhere, to be built, we understand, at Madison, Ill.

The Omaha (Neb.) Electric Light & Power Company is about to install a steam turbine of some 2,000 horse-power, with generator. It was presumably ordered some time ago.

The Rock Milling & Elevator Company, of Great Bend, Kan., is starting to erect a 75,000-bushel elevator at Hutchinson, and contemplates building a mill there next spring.

Tibby Bros. Glass Company, bottle manufacturer, which recently sold its plant in Sharpsburg, Pa., to the Pennsylvania Railroad, has purchased property in West Etna.

The electric lighting and steam heating station owned by the Presque Isle (Me.) Electric Light Company and the mill of the Aroostock Lumber Company have been burned.

S. H. Wilson, an expert cutler, for many years employed in a factory at Fremont, O., is at the head of a project to establish a new concern there for the manufacture of pocket cutlery.

Parties unnamed have been trying to get a freight car building plant to move to Binghamton, N. Y., from Belvidere, N. J., and at the time of report there was good hope of success.

J. Franklin Stuckert & Son, Philadelphia, are furnishing working drawings for a large plant for the Quaker City Rubber Company, at Comly street and Delaware avenue, Wissinoming.

The Pennsylvania Railroad Company will erect large repair shops at Millham Junction, two miles east of Trenton, N. J. There will be seven buildings in the group. Work will begin at once.

The stockholders of the Meridian (Miss.) Fertilizer Factory have agreed to allow $150,000 for improving their works, but this improvement will be made at Hattiesburg instead of Meridian.

The plant of the Knightstown (Ind.) Torpedo Company has been destroyed by an explosion of nitro-glycerine. A hole estimated at fully 40 feet in diameter and 15 feet deep was torn in the ground.

A good-sized extension is about to be built to the open-hearth plant of the Midvale Steel Works, in Nicetown, Pa. It will contain electric cranes of 25, 75 and, according to report, 150 tons capacity.

Plans have been completed for the enlargement of the Noble Foundry & Machine Shop, Fort Wayne, Ind., by a building, 50x200 feet, two stories. The building will contain offices and presumably shop room.

W. I. Young, of Greensboro, N. C., and J. E. Sirrine, of Greenville, S. C., representing the Etowah Cotton Mill Company, has made an arrangement for the establishment of a cotton mill at Mabank, Tex.

The city council of Gurdon, Ark., recently granted to S. Scott Harris and Dr. T. L. Hodges a franchise for an electric light and power plant, and it was intended to secure estimates on the plant at once.

W. B. Howard, of the Georgia Supply Company, Savannah, and E. V. D. Johnson, of Pittsburg, Pa., are promoting a company to build one or more turpentine plants, which, it is said, will employ a new process.

A big canning plant is likely to be built this season at Mobile, Ala. Secretary Wilmer, of the Commercial Club, and T. W. Wade, president of the Mobile State Packers' Association, are in touch with the matter.

The Composite Brick Company, of New Haven, Conn., a new concern in which W. J. Atwater, Edward Munson and other New Haveners are interested, will erect a plant to make a new variety of brick at Fair Haven.

Plans have been made for a new 35x75-foot power-house of the Gardner Governor Company, Quincy, Ill. Electricity will hereafter be the sole motive power used. The new power plant will allow more shop room.

The National Woven Wire Company, of Chicago, Ill., is coming to Niles, Mich., and will occupy the second floor of the plant at that place of the Garden City Fan Company, of Chicago. A warehouse will be built for the concern.

A structural steel manufacturing company is being organized at Red Oak, Ia. Among the prominent stock subscribers are C. H. Wilson, who seems to be promoter; Henry Peterson, A. C. Hinchman, Thos. Griffith and R. M. Roberts.

The Kalamazoo Beet Sugar Company's plant at Kalamazoo, Mich., is to be moved to Chippewa Falls, Wis. Capitalists controlling the Kalamazoo factory have organized the Chippewa Falls Sugar Company with a capital of $700,000.

The Sawyer-Goodman Company will, it is understood, build a large woodenware manufacturing plant at Menominee, Mich., to operate in connection with its sawmill. The company is also building a planing mill at an outlay of $100,000.

A new crucible steel plant is proposed for Scottdale, Pa., to employ a process invented by a Mr. Robinson, for converting pig iron into Swedish melting bar. A meeting has been held, W. L. Kelly, of that place, presiding, and H. C. Wilson acting as secretary.